# HEATING & VENTILATING

AIR CONDITIONING

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FOR DECEMBER, 1936


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*For Engineers and Contractors Controlling the Design, Specification, Installation and Maintenance of Heating, Ventilating and Air Conditioning.*

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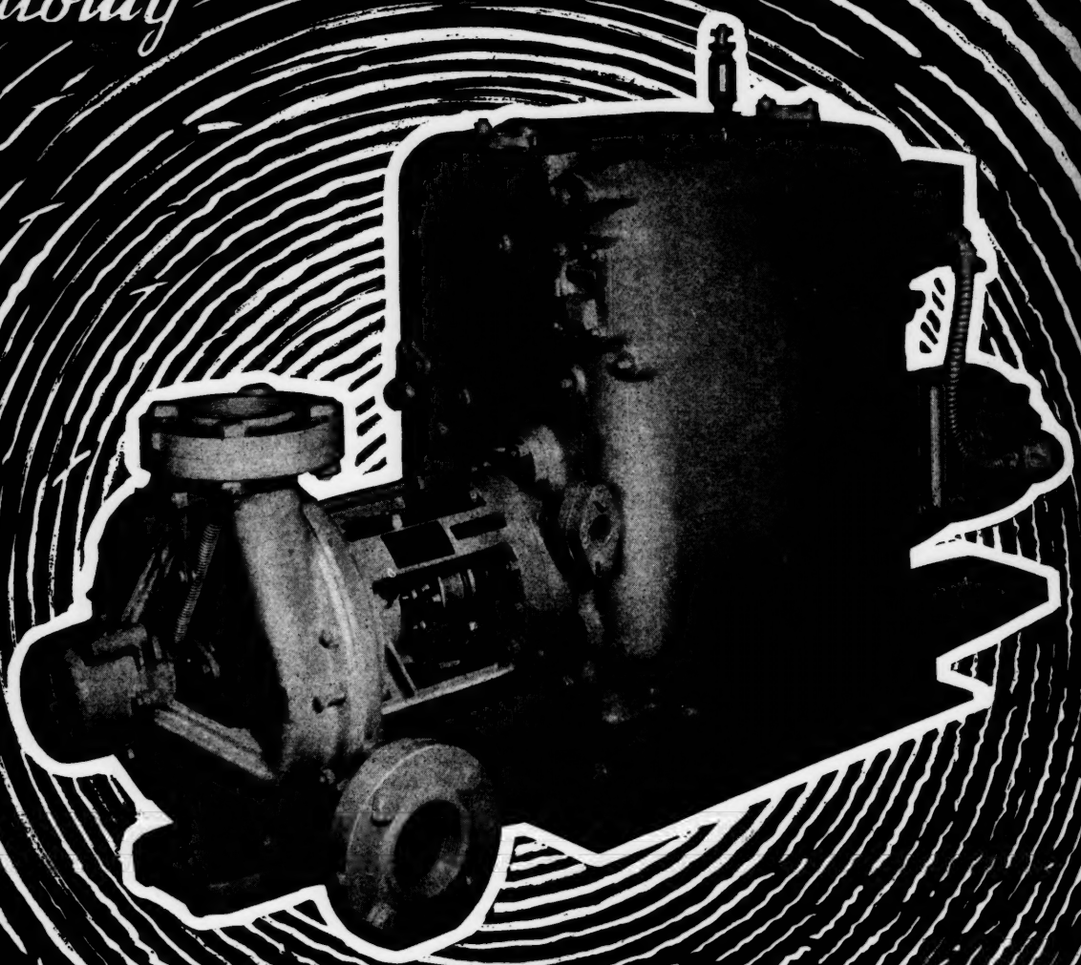
*Centralized Heating Economy*



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# The Welding of Wrought Iron

THE rapid increase in the utilization of wrought iron products for various applications where fabrication is accomplished by welding and the fact that wrought iron differs both physically and chemically from other ferrous metals suitable for welding, have made it desirable to establish recommended procedures to follow when welding wrought iron by the commonly used processes. Wrought iron is easy to weld but in order to obtain the best results the welding engineer should be thoroughly familiar with the material and its characteristics which influence weldability.

Wrought iron is a two component metal consisting of high purity iron base metal and iron silicate. The iron silicate is a glass-like slag. These two materials are in physical association, as contrasted to the chemical or alloy relationship that generally exists between the constituents of other ferrous metals.

The iron silicate or slag content of wrought iron varies from about 1% to 3% or 3½% depending upon the type or class of product. In the form of plate, for example, it usually amounts to about 3% by weight. This constituent is distributed throughout the iron base metal in the form of threads or fibers which extend in the direction of rolling. The slag fibers are distributed so thoroughly throughout the iron component that there may be 250,000 or more to each cross-sectional square inch of finished material. This confers on the material a definitely fibrous structure which can be observed readily if a piece is nicked and fractured.

Each of the two dissimilar materials that go to make up wrought iron has its own fusion temperature. The iron base metal, because of its low metalloid content, fuses at a temperature of about 2730F, which is somewhat higher than the melting point of low and medium carbon steels. The slag component fuses at temperatures between 2100 and 2200F, or several hundred degrees lower than the base metal.

The purity of the base metal gives wrought iron the ability to withstand higher temperatures than other ferrous metals and, in general, it should be worked hotter for best results. Also, the protection afforded the metal during heating by the fluxing action of the slag has a beneficial effect in producing sound welds. This is a particularly important factor in making plastic welds.

### Processes and Procedures

Wrought iron can be welded easily by any of the commonly used processes, such as forge welding, electric resistance welding, electric metallic arc welding, and gas or oxy-acetylene welding. The first two, of course, come under the classification of plastic welding, while the latter two are classed as fusion processes.

### Plastic Welding

When welding wrought iron by either the forge or the electric resistance method, the important point to keep in mind is that the metal must be worked somewhat hotter than steel. In forge welding, for example, wrought iron is worked at what is termed a "sweating heat," which corresponds to a temperature of about 2500-2550F.

TABLE 1.—MANUAL OXY-ACETYLENE WELDING PROCEDURE†

| Thickness of Plate | 1/8 | 1/4 | 3/8 | 1/2 | 5/8 | 3/4 | 7/8 | 1 |
|---|---|---|---|---|---|---|---|---|
| Angle (from perpendicular) | 30 | 40 | 40 | 40 | 40 | 40 | 40 | 40 |
| Included angle | 60 | 80 | 80 | 80 | 80 | 80 | 80 | 80 |
| Spacing between edges (starting end) | 1/32 | 1/16 | 1/16 | 1/16 | 1/16 | 1/16 | 1/16 | 1/16 |
| Spacing between edges (18 in. from starting end) | 1/8 | 3/16 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 |
| Diameter of filler metal (1st side) | 1/8 | 3/16 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 |
| Diameter of filler metal (root side‡) | 1/8 | 3/16 | 3/16 | 3/16 | 3/16 | 1/4 | 1/4 | 1/4 |
| Tip size* | 6 | 8 | 9 | 10 | 11 | 12 | 12 | 13 |
| Oxygen pressure* | 12 | 16 | 18 | 20 | 22 | 24 | 26 | 28 |
| Number of layers (1st side) | 1 | 1 | 1 | 2 | 3 | 3 | 4 | 5 |
| Number of layers (root side)‡ | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

†For single V-type joints.
‡When a double weld is required, as for example under the ASME Code, Par. U-68, or U-69, a root bead is used.
*Tip sizes and oxygen pressures are for Oxweld blow pipe No. 17. The acetylene pressure may be any value from 0 to 5 lbs. For other types of blow pipes use the tip size, oxygen and acetylene pressure recommended for steel of the same thickness.

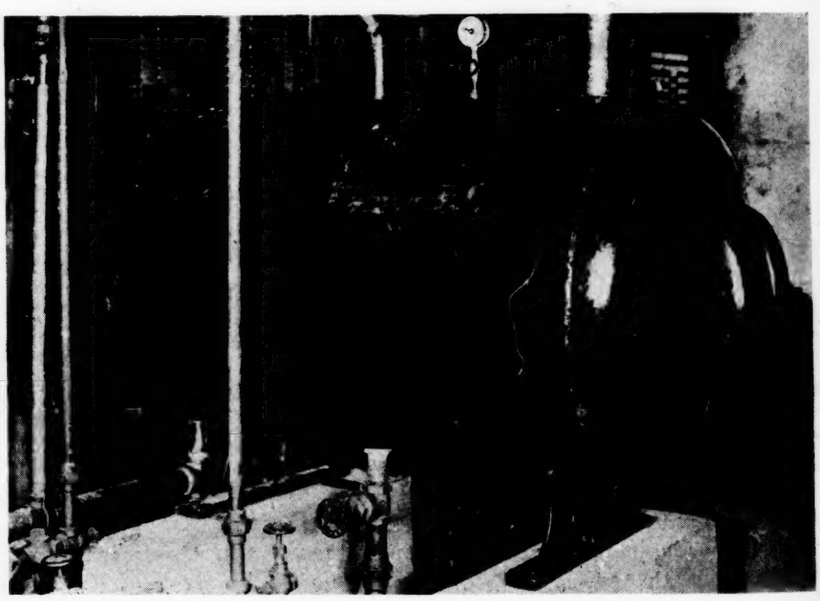
Plastic welding has been employed for many years with wrought iron. In fact, all standard wrought iron pipe and a majority of the large O.D. (outside diameter) wrought iron pipe is produced by forge welding, which embraces both roll and hammer welding. Resistance welding has been employed in fabricating wrought iron installations.

## Fusion Welding

Oxy-acetylene and electric metal arc welding are the two most generally used fusion processes. Successful welding with either process is accomplished only by following carefully the correct procedure. This is true regardless of the type of metal to be welded. Furthermore, the exact procedure used with one metal may not produce the best results if used with a different metal.

Although both the oxy-acetylene and the electric metal arc processes have been employed extensively in making welded wrought iron installations, very little research work was done until recently to establish the details of the procedure to follow in each case. A comprehensive series of tests was completed a short time ago and the results are given in the following portion of this article.

The rapid increase in the use of wrought iron plates for marine equipment led the American Bureau of Shipping and Lloyd's Register of Shipping to conduct a series of tests to determine whether or not wrought iron would meet the welding requirements established by each organization. These tests involved fusion welding of wrought iron to wrought iron and wrought iron to steel. As a result both organizations have approved the weldability of wrought iron plates.



*Wrought iron water heating tank of welded construction now in service at a Brooklyn, N. Y., plant.*

## Manual Oxy-Acetylene Welding Procedure

The procedure for welding wrought iron by the manual oxy-acetylene process is practically the same as that followed in welding mild steel of the same thickness. However, one important point to keep in mind is that the iron silicate or slag included in the metal melts at a temperature which is below the fusion point of the iron base metal. The melting of the slag gives the surface of the metal a greasy appearance. This should not be mistaken for actual fusion of the base metal and, therefore, heating should be continued until the iron is fully melted.

The best oxy-acetylene welds are produced when perfect fusion is obtained without excessive mixing of the parent metal with the weld metal. Too much rubbing or agitation of the molten metal causes the formation of oxides which may be trapped in the weld. Ordinarily, just enough of the parent metal should be fused to provide a sound bond with the filler material.

The selection of welding rod material is important. It is advisable to use a rod that has a yield point near that of wrought iron (27,000-30,000 lb. per sq. in.) and to avoid rods containing high carbon or alloys intended

TABLE 2.—MANUAL METAL ARC WELDING PROCEDURE

| Thickness of Plate | 1/4 | 3/8 | 1/2 | 5/8 | 3/4 | 7/8 | 1 |
|---|---|---|---|---|---|---|---|
| Type of joint | Single V | Single V | Single V | Single U | Single U | Double U | Double U |
| Angle (from perpendicular) | 30 | 30 | 30 | 9 | 9 | 9 | 9 |
| Included angle | 60 | 60 | 60 | 18 | 18 | 18 | 18 |
| Radius | None | None | None | 1/4 | 1/4 | 1/4 | 1/4 |
| Tongue | 0 to 1/16 | 0 to 1/16 | 0 to 1/16 | 3/32 | 3/32 | 3/32 | 3/32 |
| Spacing between edges | 5/32 | 5/32 | 5/32 | None | None | None | None |
| Number of passes | 3 | 4 | 5 | 6 | 8 | 9 | 10 |
| Diameter of electrodes | 3/16 | 3/16 | 3/16 | 3/16 | 3/16 | 3/16 | 3/16 |
| Amperes | 170 | 170 | 180 | 180 | 180 | 180 | 180 |

to increase the yield strength. In general, any high quality low carbon rod will give entirely satisfactory results.

Table 1 gives the essential details of the procedure to follow in manual oxy-acetylene welding of wrought iron. This procedure was found to produce welds of a quality to conform to the X-ray requirements of the ASME Boiler Construction Code for Class 1 welds. However, other procedures may be employed that should produce welds that are just as satisfactory.

### Manual Metallic Arc Welding Procedure

In welding wrought iron by the electric metal arc process the best welds are produced when the welding speed is decreased slightly below that used for the same thickness of mild steel. This procedure is desirable because with reduced speed the pool of molten metal immediately following the arc is kept molten for a longer period of time, thus making for more complete elimination of the gases and affording the entrained slag an opportunity to float out of the weld metal.

Also, it may be necessary to employ a slightly lower current value than that used with the same thickness of mild steel, particularly in welding thin sections where there is a possibility of burning through the material.

Excessive penetration into the face of the parent metal should be avoided. The penetration should be no greater than that required to obtain a sound bond between the deposited metal and the parent metal because fusion of an excess quantity of the parent metal tends to carry slag into the weld metal.

In metal arc welding, as in gas welding, the choice of filler metal is important. Any good quality rod either coated or bare can be used with wrought iron, but in general the coated rods are used more extensively in current installations.

The welding procedure found to produce very sound welds is given in Table 2. Other procedures may give equally satisfactory results. For certain classes of work where a greater degree of porosity may be permitted, larger electrodes, higher currents, and higher speeds may be used.

*Welded wrought iron surge tank, 18 ft. x 8 ft. x 8 ft., in the basement of a Texas telephone building. The house tank in this building is also wrought iron of welded construction.*

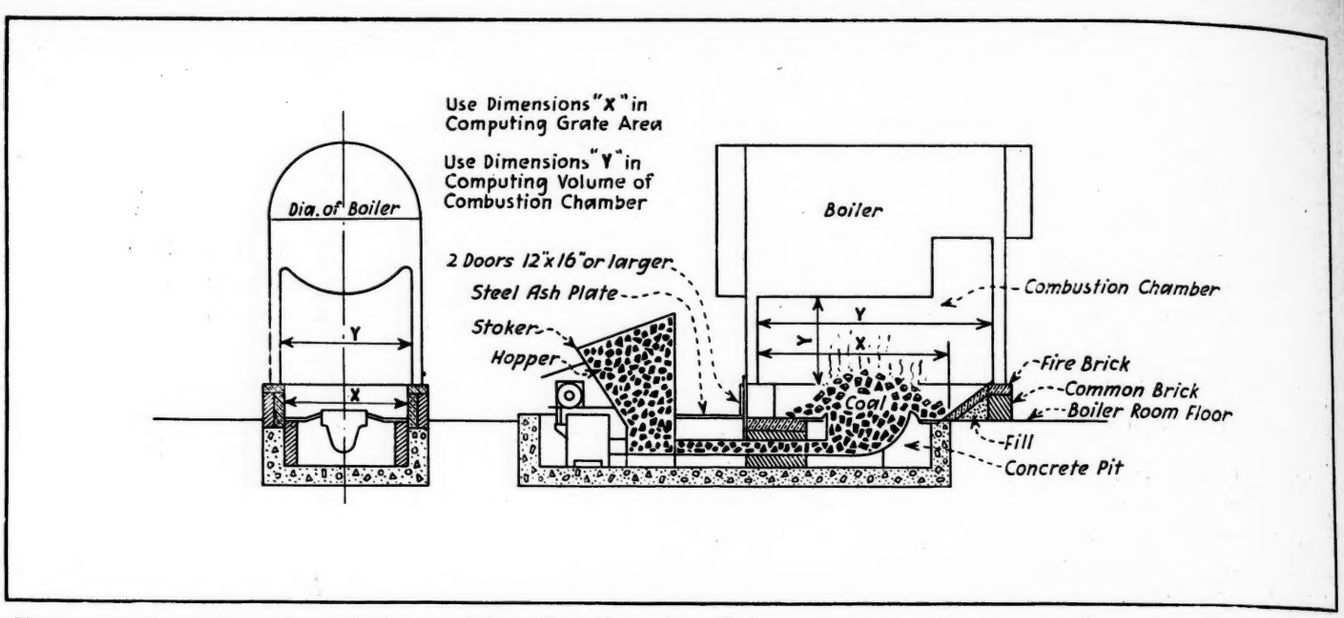
Table 3 gives the recommended rate of travel of the electrode in inches per minute that was found to produce good results. With manual operation it is practically impossible to maintain accurately a given speed, but the proper rate can be closely approximated by timing the actual rate of travel with a stop watch and then making any adjustments necessary.

In manual metal arc welding, as in gas welding, it was found that welds of a quality to conform to the X-ray requirements of the ASME Boiler Construction Code for Class 1 welds can be made in wrought iron.

TABLE 3.—MANUAL METAL ARC WELDING RECOMMENDED RATE OF TRAVEL OF ELECTRODE IN IN. PER MIN.

| Plate Thickness | 1/4 | 3/8 | 1/2 | 5/8 | 3/4 | 7/8 | 1 |
|---|---|---|---|---|---|---|---|
| 1st layer 1st side | 8 | 8 | 7 | 7 | 7 | 6 | 6 |
| Intermediate layers (1st side) | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Last layer (1st side) | 5 | 5 | 4 | 4 | 4 | 4 | 4 |
| 1st layer 2nd side | 5† | 5† | 4† | 4† | 4† | 6 | 6 |
| Intermediate layers (2nd side) | | | | | | 5 | 5 |
| Last layer (2nd side) | | | | | | 4 | 4 |

†Not used unless a double weld is specified.




*Measurements necessary for selecting a stoker. Use dimensions X for computing grate area and dimensions Y for computing combustion chamber volume.*

# Selecting a Stoker for a School Building

**By MARIUS ANDERSON†**

THE first requirements for the selection of a stoker are to have the analysis of the coal and the total heat required from the boiler. Knowing these quantities, calculations for the selection of the stoker can be started.

The efficiency of operation must be determined. This will vary widely depending upon the type of stoker used, the analysis of the coal, the type of boiler, the design of the combustion chamber, and the rate of combustion. The expected efficiency from the available heat for the generation of steam will range from around 50% to 75%. A fair average for a plant with approximately 10,000 sq. ft. of radiation will be about 65%.

To determine the amount of heat available from the coal for the generation of steam, deduct the losses due to the moisture and hydrogen content of the coal from the total heat value. The other losses inherent in the coal are small and may be neglected in selecting stokers for heating purposes.

The total maximum heat required from the boiler per hour must be determined. This will depend upon the maximum equivalent direct radiation load required to be in use at one time, but is not always the total connected load. It is very important to maintain steam pressure on the boiler at all times and, therefore, an additional load must be added to take care of pipe losses and the pickup load.

Having determined the expected heat to be developed, it is a simple matter to determine the pounds of coal required. It now becomes a problem of combustion to determine the size and shape of the furnace.

From the pounds of coal required the minimun grate area should be determined. This is arrived at by allowing a maximum of 40 to 50 lb. per hr. of coal per square foot of grate area. The grate area for an underfeed stoker should be taken as that area over which combustion will take place and not the area over which the air ports are placed.

The minimum combustion space is calculated by using a liberation of from 35,000 B.t.u. to 45,000 B.t.u. per hr. per cu. ft. of combustion space. In the ordinary water leg heating boiler the combustion space may be considered as the volume enclosed between the belly of the boiler, the side and front water walls, the bridge wall, and the top of the coal.

The distance from the top of the stoker grate to the belly of the boiler is important in producing complete and efficient combustion, and should be kept as great as possible within the limits of practical installation. Generally, in a water leg type heating boiler this distance should never be less than 3½ ft., and should always be greater than the diameter of the boiler.

Having determined these three minimum requirements, it is necessary so to select and arrange the boiler and stoker as to conform to these requirements.

In recent years boiler manufacturers have produced a heating boiler with a high water leg which has helped the stoker installation to some extent. However, arrangements must be made for the removal of the ashes and the stoker must be arranged for convenient firing. The method used in the solution of this problem will often be the difference between success and failure.

The automatically controlled underfeed type of stoker is best adapted to heating work due to the better control of combustion, and this type is used in this analysis.

It is preferable to have the front end of the boiler

†Mechanical Engineer, Olympia, Wash.

free of all obstructions. Therefore, the stoker should be arranged as a side installation where possible, or be with sufficient clearance between the hopper and boiler front for easy operation of the firedoors and cleaning of ashes. Four or five feet is generally sufficient space. In setting a stoker in front of the boiler it is often preferable to pit the stoker in order to have the ash doors at floor level and to facilitate the handling of the coal.

The boiler heating surface is always a vital factor and bears a relation to the stoker capacity. Boiler capacities, as given in boiler catalogs, are based on a definite evaporation per square foot of heating surface, approximately three and one-half pounds of steam per square foot on a hand-fired coal boiler, and approximately four and a quarter pounds of steam per square foot of heating surface on an oil or stoker fired boiler. These capacities can be increased under forced conditions, and the basis of the boiler rating should always be borne in mind when making the selection.

A capacity of 5 lb. of steam per square foot of boiler heating surface is good practice when considering the maximum rating, and a capacity of 6 or 7 lb. is possible if the combustion space grate area and height are properly proportioned.

As an example of the calculations of a stoker installation take the case illustrated.

**Example**

A new junior high school was constructed approximately 600 ft. from the existing high school building. The two buildings are heated by the boiler in the present high school. The following data are available:

| | |
|---|---|
| Existing building equivalent direct radiation | 6,500 sq. ft. |
| New building equivalent direct radiation | 7,000 sq. ft. |
| Present boiler low pressure, water leg type, hand fired with coal, having a heating surface of | 635 sq. ft. |
| Approximate analysis of coal to be fired | 10,000 B.t.u. as rec'd. |
| | 15 % ash |
| | 42 % volatile |
| | 6 % moisture(total) |
| | 4.6 % hydrogen |

From the foregoing information the following calculations are made:

| | |
|---|---|
| Total square feet of radiation | 13,500 |
| Add for pipe losses | 2,000 |
| Add for hot water load | 1,000 |
| Total connected load | 16,500 sq. ft. |

Each building is valved separately at the boiler, but it is not advisable to warm up one building at a time as all portions of both buildings are used during school periods. The total demand load on the boiler and stoker is therefore assumed at 16,500 sq. ft. of equivalent direct radiation at 240 B.t.u. per sq. ft.

16,500 sq. ft. of direct radiation equals 3,960,000 B.t.u., or the heat to be developed from the boiler. This is 4,081 lb. of steam at 212F. This gives an evaporation of 6.14 lb. of steam per square foot of boiler heating surface.

Assume a stack temperature of 450F.
Assume coal temperature at 50F.

| | | |
|---|---|---|
| Loss due to moisture | 73 | B.t.u. |
| Loss due to hydrogen | 515 | " |
| Total loss | 588 | " |
| Available heat for generation of steam | 10,000 | B.t.u. |
| Minus | 588 | " |
| | 9,412 | " |

With 65% efficiency: 0.65 × 9,412 = 6,118 B.t.u. in steam developed per pound of coal burned.
3,960,000 ÷ 6,118 = 647 lb. of coal.

A stoker with a capacity of 700 lb. of coal per hour was selected as this was the nearest commercial size.

Combustion volume required = 700 × 10,000 ÷ 40,000 = 175 cu. ft.
Grate area = 700 ÷ 45 = 15.5 sq. ft.

It is notable that with these figures the installation has proved satisfactory in all respects. A temperature of 70F has been maintained within the buildings when the outside temperature was 8F above zero and the wind velocity was 15 m.p.h.

## Air Conditioning as a Form of Fire Insurance

FIRES increase in the cold weather, and outbreaks in which the fire may spread "with explosive rapidity" occur from time to time. On December 27, 1935, for example, a considerable fire in Chelsea, Mass., spread with such rapidity that a girl working on the second floor of a shop was trapped and forced to jump to save her life. This fire is presumed to have been caused by embers from a dump. An incinerator set another fire the same day. Of course, more fires are to be expected in cold weather, for there are more domestic fires for heating and heating plants in buildings are pushed harder. But there is another factor not generally recognized, namely, the extremely low humidity indoors in zero weather. On a cold winter's day the dewpoint is often —5F, at which temperature the vapor present is but 1 gram per cubic meter. If this air is heated to a temperature of 75F, at which there could be 22.5 grams of water vapor per cubic meter, the relative humidity is but 1/22.5 of saturation or under 5%. Forest fire hazards are great when humidities are under 30%, and extreme at humidities below 20%. So it is easy to see how hazardous these low humidities are from a fire standpoint in wooden buildings. The humidity was very low on December 27, dewpoint 0F.—*Bulletin American Meteorological Society.*

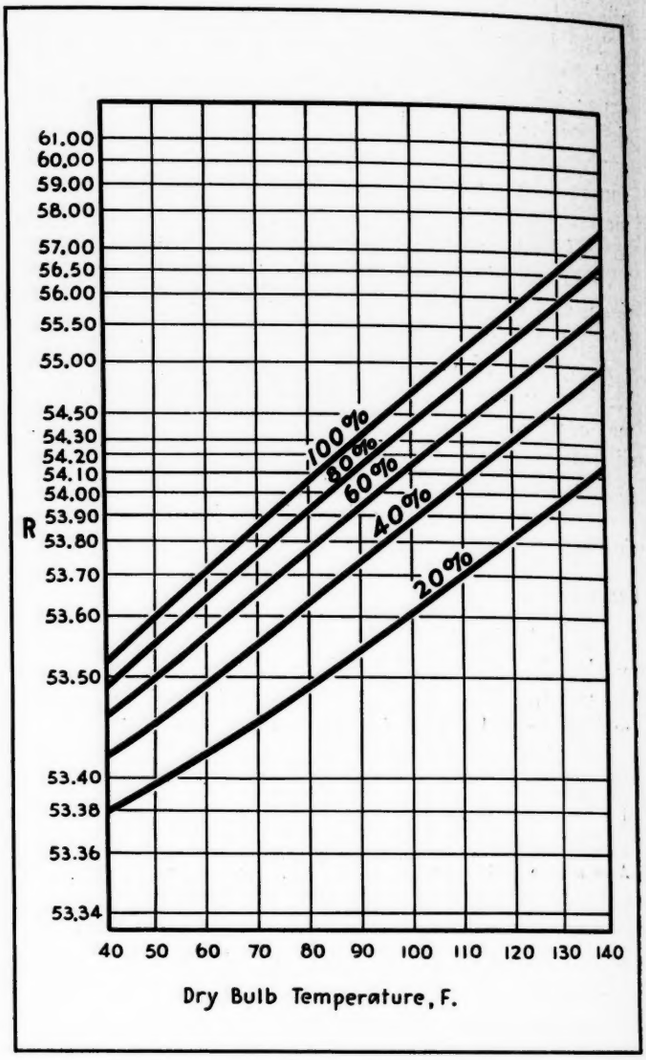
# Gas Constant for Humid Air

By A. H. ZERBAN†

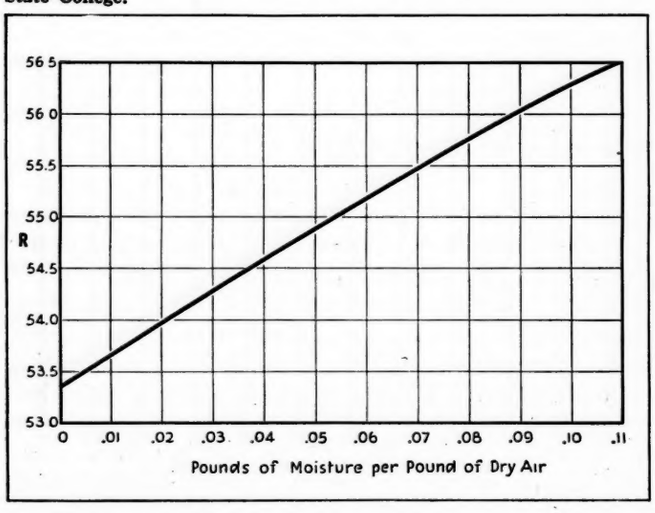
A USEFUL fact when dealing with air-vapor mixtures is that for any given specific humidity (pounds of moisture per pound of dry air) there is a definite value of the gas constant $R$ in the characteristic equation $PV = RT$. Hence, if the specific humidity is determined at any convenient point in a flow problem, the corresponding value of $R$ can be used at any other point provided, of course, that no moisture is added or removed from the air. In flow calculations, this simplifies the work of computing accurately the specific volume (or its reciprocal, the specific weight) for any given static pressure and dry bulb temperature. It is also convenient for converting velocity head readings. Ordinarily, velocity head is determined by a manometer reading in inches of water, and this is converted to feet of air by multiplying by the ratio of the specific weight of water to that of air. In computing the specific weight of air, the absolute static pressure and the absolute temperature are used in the characteristic equation and, unless the air is very dry, some error is introduced if the value of $R$ is taken as that of dry air, 53.34. When the specific humidity is 0.001 lb. of moisture per pound of dry air, this error is less than 0.06%, but when the specific humidity is 0.100 lb. of moisture per pound of dry air, the error is over 5%.

Fig. 1 shows a curve whose ordinates are values of $R$ for humid air mixtures and whose abscissas are values of specific humidity. $R$ is expressed in foot-pounds per pound per degree; specific humidity is expressed in pounds of moisture per pound of dry air. Among the advantages of this curve is the fact that it can be used irrespective of barometric conditions. If the abscissa had been based on absolute humidity in pounds per cubic foot, or on relative humidity, the curve would be accurate at only one pressure.

Fig. 2 shows a series of curves of constant relative humidity whose ordinates are values of $R$ and whose abscissas are dry bulb temperatures, Fahrenheit. These curves are plotted for standard barometric conditions of 29.921 in. of mercury. Obviously, the values of $R$ could be incorporated into the usual psychrometric chart as a function of the specific humidity.




†Assistant Professor of Mechanical Engineering, The Pennsylvania State College.



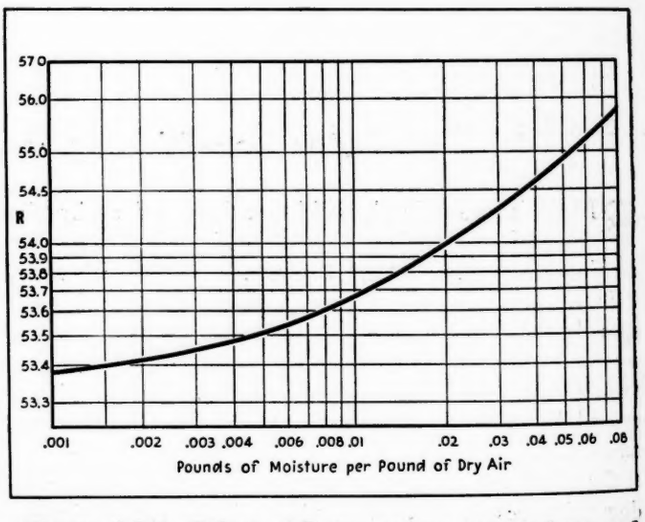
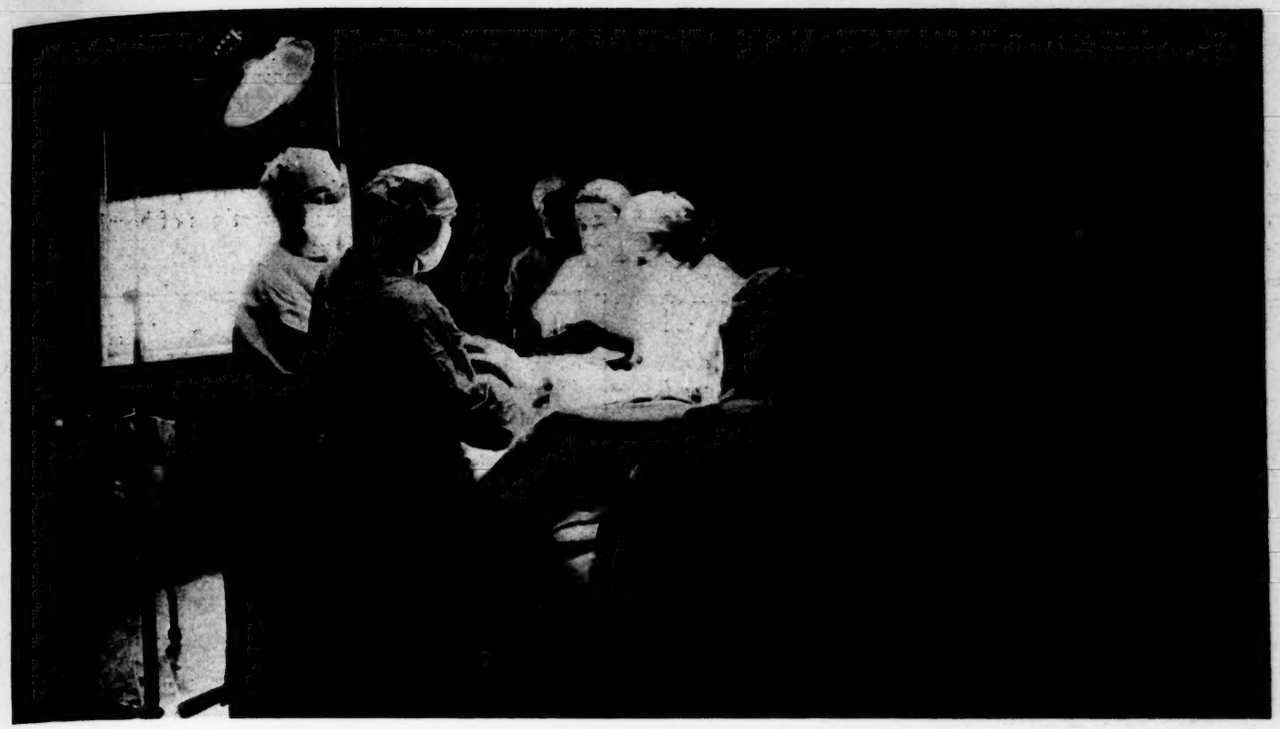




*Fig. 1. (Left). Values of* R *for various specific humidities. Fig. 2. (Upper right). Values of* R *for various temperatures and relative humidities. Fig. 3. (Lower right). Same as Fig. 1 except that logarithmic coordinates are used to facilitate readings of low humidities.*



# Air Conditioning in Hospitals and Dental Offices Surveyed

THERE are nearly 65,000 dentists in the United States with an average gross income varying from about $5,000 per year for dentists in practice four years or less to $9,500 for dentists in practice from ten to fourteen years. An important percentage of these constitutes a large market for air conditioning equipment, the number of actual prospects for installation depending on the cost of the equipment.

The following table classifies dentists by incomes, the table being from a survey by the American Dental Association:

| Gross Income | % of the Profession | No. of Dentists in this Group | Average Income of this Group |
|---|---|---|---|
| Under $5,000 ..... | 41.8 | 26,334 | $3,611 |
| $5,000—$10,000... | 40.1 | 25,263 | 7,502 |
| $10,000—$15,000... | 14.5 | 9,135 | 12,270 |
| $15,000—$20,000... | 2.5 | 1,638 | 17,100 |
| $20,000 and over ... | 1.0 | 630 | 25,522 |

Many of these dentists have already installed conditioning equipment, and the experiences of such dentists with air conditioning have been surveyed and the results published by Oral Hygiene Publications† through whose courtesy we are able to abstract some of the findings of the survey.

The survey covered 230 dentists, 40% of whom replied. Following are some of the questions together with their answers (or parts of their answers) abstracted from the survey:

*When was air conditioning installed?* Thirty-eight reported their equipment in service for over two years, 23 for between one and two years, and 25 for less than one year.

*Office located in home or office building?* 4.7% reported office located in home while the remainder reported office in office building.

*Is entire office air conditioned or only your operating room?* 76% reported their entire office while remainder reported only their operating room. Two of those whose offices are located in their homes said their entire homes were air conditioned.

*Do you operate your unit in other than summer months?* 81% reported that they used the air conditioning equipment only in the summer while remainder reported year 'round service. Of the latter group, five are located in southern states.

*Does your experience lead you to believe that an air conditioned office decreases the strain of operating work on the part of the dentist?* Answers to this question were 100% affirmative.

*What effect has air conditioning on the attitude of your patients?* Answers to this question were 100% favorable.

*Have you found air conditioning to be of any value as a practice builder?* Of those replying to the questionnaire 53½% replied that it had, 42% gave indefi-

†Whose address is 1005 Liberty Ave., Pittsburgh, Pa. A limited number of copies of the complete survey is reported to be available.

nite answers, and the remaining 4.5% did not answer the question.

*How does your practice now compare with the summer months prior to the installation of air conditioning?* 22% of the total replies gave definite figures in answer to this question, as follows: Of these, 37% reported increases of from 10 to 20%, while 63% reported increases of 25% or more. Average increase for those reporting definite figures—28%. Thirteen per cent of the total reported increases but gave no figures, while 65% of the total gave negative or uncertain answers.

*Regardless of any beneficial effect of air conditioning upon practice growth and upon patient comfort, does your experience lead you to believe that it is a good investment solely because of the improved operating conditions for the dentists?* Eighty-two gave affirmative answers, one a negative answer, and the remainder indefinite answers.

*What is cost of operating your unit in summer months?* It is difficult to compile the replies to this question. Some were given in cost per kilowatt, others could give no figures. Monthly operating costs of those who had figures were from $2 to $8.

### Hospital Air Conditioning

It is doubtful if there are more than from 200 to 300 hospitals in this country using air conditioning, according to the 1936 report of the Committee on Air Conditioning of the American Hospital Association‡. In response to a questionnaire sent out by the committee about 80 hospitals replied, of whom 48 had air conditioning equipment actually installed. These were distributed geographically as follows: eastern states, 8; midwestern states, 18; southern states, 10; western states, 2; southwestern states, 10.

Of 26 hospitals which replied regarding their bed capacity, six hospitals having air conditioning have a bed capacity under 100 while 12 have a capacity of from 100 to 300, and the remaining eight have over 300. Twenty-nine hospitals gave the date when the installation was made in their building as follows: 1929, 3; 1930 and 1931, none; 1932, 1; 1933, 3; 1934, 11; 1935, 9; 1936, 2. The following table from the committee's report shows what particular portions of hospital buildings used air conditioning:

| Part of Building | No. of Hospitals Reporting Apparatus |
|---|---|
| Entire wing or building | 3 |
| Operating rooms or suites | 19 |
| Delivery rooms or suites | 4 |
| Newborn nurseries | 9 |
| One or more private rooms | 8 |
| One or more wards | 2 |
| Labor rooms | 2 |
| Anaesthesia rooms | 3 |
| Dining room | 1 |
| Lounge | 1 |
| Premature nursery | 1 |
| Sterlizing room | 1 |
| Oxygen room | 1 |
| Operating room galleries | 1 |

Cooling led in the functions included in air conditioning equipment used, 23 hospitals reporting this function with 17 reporting air filtration, 19 reporting dehumidification, and 14 humidification.

According to the committee, the amounts of recirculation reported ranged from 20 to 70% or an average of about 50%. One hospital found 60% recirculation unsatisfactory on account of odors, reduced to 45% and found that rate "fine."

Answers to the question put by the committee as to the degree of relative humidity maintained was varied, the reports ranging from 50 to 65% in nurseries and from 40 to 65% in operating rooms. In the opinion of the committee 55% is about optimum for operating rooms and less than 50% increases dangers of explosions of anaesthetic gases.

‡A report of this committee has been published as Bulletin 139 by the American Hospital Association, Inc., 18 East Division St., Chicago. The bulletin, paper bound, contains eight pages; size 5⅝ x 8¼ in.

## Scientists Propose Air Conditioned Farm

AN air conditioned farm, with fields lighted like city streets, would help along the growing of plants, according to the results of recent experiments by scientists at Smithsonian Institution, the Department of Agriculture, and Purdue University. A summary of the work along that line was prepared recently by the radio division of the Office of Education for use on its Smithsonian program.

The cost of such an arrangement would prohibit the use now of some of the discoveries in open farm fields, but others are being used in greenhouses.

Experiments in lighting have demonstrated that plant growth may be hastened along by turning on greenhouse lights for several hours each night. Some plants require more light to make them grow than others.

A light equal to double that of bright winter moonlight will set asters blooming. Some plants like red light, but it slows down others.

Smithsonian scientists are still trying to measure the relations of light intensity and color to plant growth.

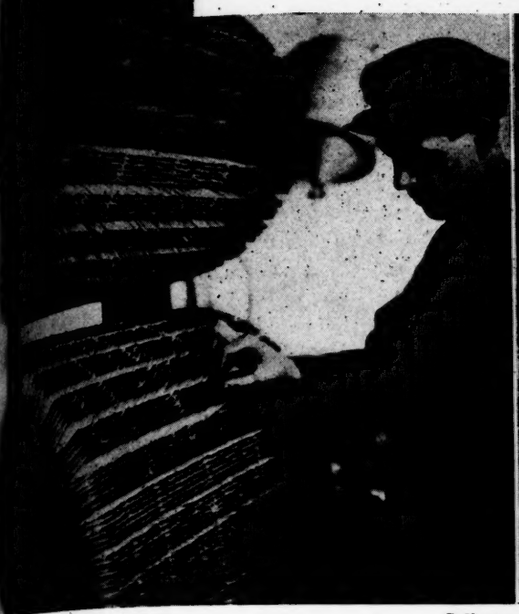
The amount of carbon dioxide in the air also affects plant growth. Experiments with wheat showed that when the plants were supplied with air containing four times the normal amount of carbon dioxide, there were more stems from the root, the straw was heavier, there were more heads, and the heads were heavier and contained more grains. The time of heading was, however, slightly delayed.

Blue light retarded growth most when applied to oat seedlings. Orange and red light did not deter them.

In general, the scientists concluded that it was possible to make plants grow faster, vegetate more, stop vegetating and go to seed as the grower willed.

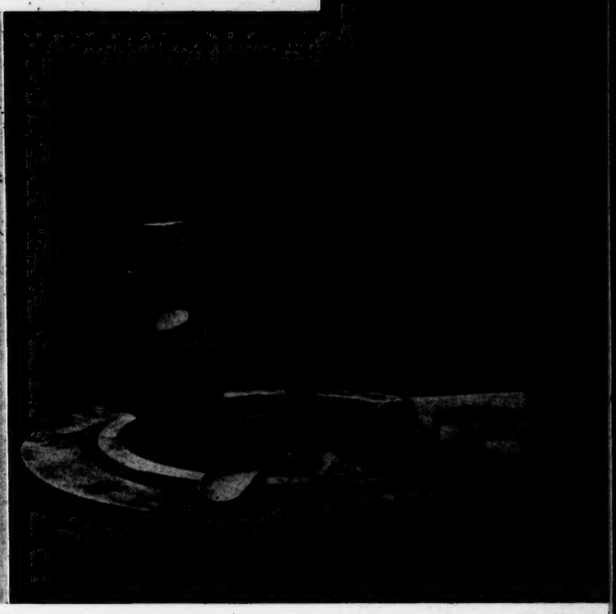
But, while this might be done in the laboratory, adapting this knowledge to growing plants in the open field was set down as altogether another problem.

# AIR CONDITIONING IN INDUSTRY



Galloway

Textile World



Galloway

## 2—Manufacture of Matches, Textiles, and Tobacco Products

By MARY O. SOROKA†

AIR conditioning in industry was first introduced twenty-five years ago and was developed largely through its adoption by the textile, printing, and confectionery interests. Mass production meant the concentration of machinery with consequent abnormal temperature and humidity conditions. Idle equipment was not compatible with huge capital investment and manufacturing had to go on regardless of atmospheric conditions. Air conditioning was the solution to continuous production, and some industries, such as the manufacture of rayon, are completely dependent upon it. Comfort conditioning is largely an outgrowth of the necessity of the factory.

Most materials of vegetable or animal origin, and to a lesser extent minerals in certain forms, take moisture or give it up to the surrounding air. Solid materials contain water in either or both of two characteristic forms. One form is free or capillary moisture, and is made up of the water contained in the capillary spaces between particles or fibers. The second form, called absorbed or hygroscopic moisture, is closely associated with the physical properties of the material. Removal of the capillary water has little or no effect upon the material except to reduce weight, but withdrawal of the absorbed water results in changes in physical properties and characteristics. This article is concerned with the hygroscopic moisture of material as it affects manufacturing.

†Engineer, Julien P. Friez & Sons, Inc., subsidiary Bendix Aviation Corp., Baltimore, Md.

### Mechanics of Removing Moisture by Air

It is perhaps advisable to pause here to review the mechanics of moisture changes in materials. With every hygroscopic material an equilibrium condition is set up between the vapor pressures of the air moisture and the moisture in the surface of the material, when no further moisture removal takes place. The presence of free water on the surface of a material indicates that the vapor pressure within the material is higher than the vapor pressure of the air currents over its surface. If all free moisture disappears from the surface and the hygroscopic material still contains a higher percentage of water by weight than is desired in the finished product, the vapor pressure of the air must be reduced by decreasing the relative humidity.

Many processes involve the use of drying but each specific material must be exposed to air conditions suited to it. Use of too dry air when beginning an air drying operation may result in the danger of drying the material too rapidly at the surface, causing what is often referred to as case-hardening. To avoid this the air should be supplied at a controlled wet bulb temperature depending on the best drying temperature of the material. The relative humidity of the drying air is kept at such a value that the vapor pressure of the air is slightly lower than the vapor pressure of the material. The air circulation is continued until the moisture content of the material being dried is brought to the point desired. Automatic control devices regu-

late the work done by the air conditioning equipment in accordance with the fluctuating requirements.

Those who have had long years of experience with the air drying process state that proper handling of the drying air to insure contact with the surface of the material being dried is essential. Some materials are strong enough to withstand strong blasts of air while others must be dried in an even, gentle stream of air to secure satisfactory results.

The effects of the moisture in the atmosphere upon materials have been known for centuries and the first absorption hygrometer dates from 1664 when a band of paper was used as the hygroscopic body. Instruments followed shortly thereafter using cotton, silk, wood, catgut, whipcord, sponge, ivory, gold beaters skin, goose quills, whalebone, human hair, etc., as the indicating medium. It is to be expected, therefore, that such materials will change radically with changing air conditions. Nevertheless, the physical properties of the materials used in manufacturing must be controlled in order to permit permanent adjustment of machinery regardless of the changing atmosphere.

In preparing many materials, conditions are not maintained constantly, but different temperatures and humidities are held for varying lengths of time. It is generally considered that relative humidities below 40% tend toward dryness or a low moisture content, brittleness in fibrous materials, and the presence of static electricity. Humidities above 80% tend toward dampness, high regains, and soft and bendable conditions generally.

### Rayon Manufacturing

In the manufacture of rayon, the raw product is cellulose. Each step requires characteristic controlled air conditions, from the soda room where wood pulp is treated with caustic soda in presses, through storage where crumb cellulose is stored before it proceeds to the churn room to be treated with carbon bisulphide. After mixing and filtering, the green viscose goes to cellars where slow aging takes place. The temperature must be kept constant to insure that the chemical reactions proceed at a constant and suitable rate.

In the next process, where the liquid viscose is spun into thread, air conditioning is necessary to retard evaporation and prevent crystallization of the sulphates on the finished thread. A relative humidity of 80% is commonly used. Adequate ventilation must be provided, both supply and exhaust, in order to dilute the fumes from the sulfuric acid bath and exhaust them. Reeling, sorting, inspection, spooling, quilling, and warping,—each requires its own set of air conditions. Accurate, sensitive, and reliable control of humidity and temperature is vital. For spinning, a temperature of 70F d.b. and a relative humidity of 85% is said to be desirable and for twisting, 70F d.b. and a relative humidity of 65%.

### Cotton, Silk, and Wool

In the preparation process in a cotton mill a relative humidity of 50 to 55% gives the best result, but as the cotton fiber comes to the spinning operation more flexibility is needed and the relative humidity is increased. As a general rule the finer woven and higher grade textiles need higher relative humidity, while heavier and coarser goods can be produced under drier atmospheric conditions.

In practically all of the operations involved in processing cotton, silk, and wool fibers a temperature of 75 to 80F is considered suitable except in the case of cotton spinning where there is greater leeway (60-80F) and in cotton weaving where the range is placed at 58-75F. With these temperatures, relative humidities are kept within the 60-70% range generally, but cotton carding and wool weaving are often carried on in air at 50 to 55% relative humidity, while cotton carding and wool spinning are kept within the 55 to 60% range.

The manufacture of woolens and knitting has been carried on in those localities which have the geographic advantage of a moist climate, which is why such fine woolens come from England; however, it is possible to simulate conditions inside the factory which make the production of high grade woolen materials possible elsewhere.

When all the departments of a factory are to be served by the same central humidifying apparatus with all the air leaving the air washer at the same dewpoint, the different relative humidities for each process may be produced by automatic controls. Extremes of temperature and humidity which are often best suited to a particular process are not always best suited for the health, comfort, and productive efficiency of the people who are working, and a compromise if often desirable.

Contrary to the practice in ice cream plants, mentioned earlier in this series, in which air conditioning is used to prevent excess moisture conditions, the air conditioning of textile mills is designed to create extreme conditions. One of the major nuisances in industries where high relative humidities are necessary is the condensation which gathers on cold walls and window surfaces in cold weather. It is necessary to insulate roofs to prevent dirty water from falling on goods in the process of manufacture as well as to provide gutters below skylights and side windows. In addition to the deterioration of buildings due to the corrosion of steel and rotting of wood, condensation may cause deterioration of machinery, particularly electric motors, unless they are totally enclosed. An anti-condensation device can be used to ring a warning bell or show a light when atmospheric conditions outdoors are such that dripping will occur.

### Tobacco and Tobacco Products

Tobacco is another interesting example of what may be done by industrial air conditioning in the control of color, texture, and flavor for cigar, cigarette, plug, or pipe products. Air conditioning is necessary from the very time that the tobacco is harvested and brought in from the fields. It is immediately stored in buildings with very high relative humidities and temperatures (over 90F) in order to hasten the fermentation which ages the tobacco and improves its qualities. In preparation for stripping the tobacco undergoes what is known as a softening operation, being automatically heated, moistened, and then cooled. Following the stripping, the tobacco is sent to the blending department where

it is sprayed with seasoning juices, following which it passes to the dryer, and subsequently to the bulk room where it is stored and where the juices distribute themselves throughout the tobacco; the bulk room has controlled air conditions so that the seasoning is properly done. After seasoning in the bulk room the tobacco passes into the cutting room which is air conditioned so that the tobacco will be soft and pliable and so that the machines will not break or tear it. After cutting comes the drying operation following which the tobacco is again stored, this time for a day, in a storage room which is also air conditioned.

In the rooms where the automatic cigarette making machines are working air conditioning is necessary. The amount of tobacco fed upon the strip of paper is controlled by a spring pressure. If the tobacco is too moist and consequently too soft the spring will force too much tobacco into the strip and there will be too much tobacco in the cigarette. The converse is true when the tobacco is too dry, in which case the cigarette will have too little tobacco in it. Consequently, if the air conditions in the machine room are not controlled the machines must be readjusted constantly to keep in line with the shifting air conditions. Therefore, it is desirable that a constant temperature and humidity be maintained in order to keep every machine operating at maximum capacity.

Temperatures and humidities for three operations in the tobacco industry are shown below:

| Operation | Temperature, F | Relative Humidity, % |
|---|---|---|
| Cigar and cigarette making ..... | 70-75 | 55-65 |
| Softening ..... | 90 | 85-88 |
| Stemming or stripping ..... | 75-85 | 70-75 |

Tobacco is more easily handled when it is moistened enough to be soft and pliable but it should not be too wet or it will mold and lose its flavor. Inaccurate methods of moistening tobacco such as spraying or dipping in water may be costly through causing deterioration in the tobacco's characteristics or darkening, the latter being a loss of color which seriously affects a cigar's value.

Natural conditions in the West Indies have made it desirable to manufacture tobacco products in those islands, the air conditions being quite suitable for hand rolling of fine cigars.

Air conditioning, however, has made it possible to perform these operations in the northern part of the United States. In one cigar factory in Philadelphia all phases of tobacco treatment are reported to be carried on in the same building with the actual rolling of the cigar. It is only through careful air conditioning that it is possible to make an installation of this type and keep the latent heat from the manufacturing sections, some of which are held at 70% relative humidity, from filtering into the business sections.

The dewpoint at this plant is controlled by hygrostats on representative floors working within a high and low limit arrangement with a master thermostat at the humidifier discharge. This system is responsive to rapid load variations and the limit device prevents too great variation in either direction and is useful in maintaining minimum temperatures over week-ends.

### Match Manufacture

Smokers are not only indebted to air conditioning for the uniform quality of their tobacco, but some types of their matches are produced with the aid of controlled air conditions.

Ordinary wooden matches are made by machines. White pine sticks, inserted in plates, are carried by belts, so that the sticks are dipped into a mixture which contains the material which forms the head. The plate continues to move along until the head has been partially dried, when the matches are again dipped into a second tank, where they receive the ignition tip. Then matches are dried for about an hour.

The best air conditions are said to be about 75F dry bulb and 40% relative humidity. The matches are slightly moist when removed from the plates since they are not so liable to ignite when wet.

Due to the danger of ignition of the matches it is not possible to dry them by raising the dry bulb temperature, the alternative being to use air of very low relative humidity.

*This is the second of a series of articles by the author. The third will appear in an early issue.*

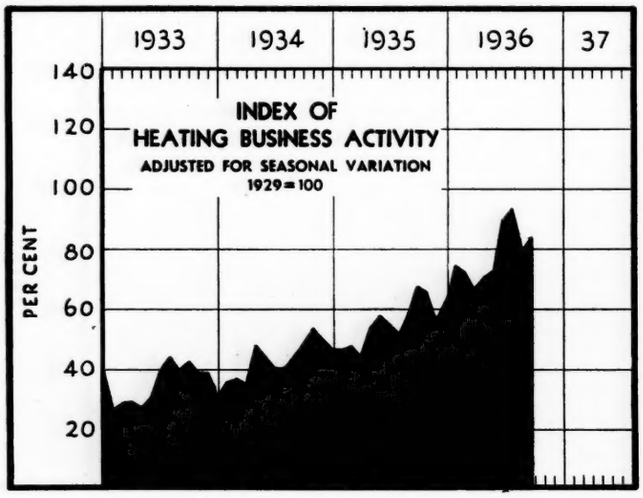
## History of Oil Heating

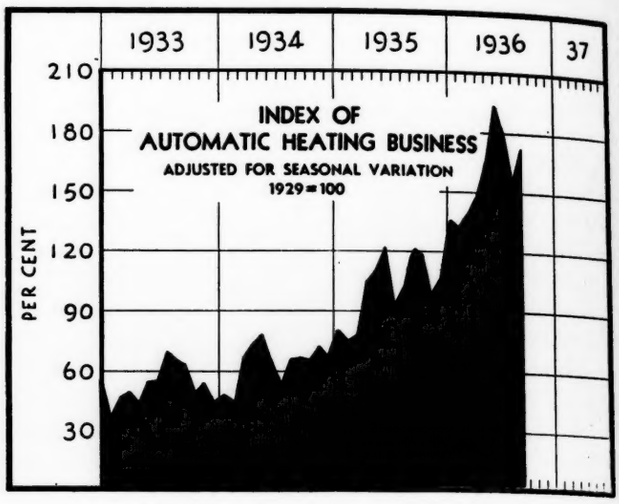
OIL burning devices are as old as commercial petroleum, but the automatic home oil burner is really a modern invention. Soon after oil development began in western Pennsylvania in 1859, there started a crude method of burning heavy fuel oil by use of a pan or step over which the oil flowed and was ignited. In 1862 the Americans, Shaw and Linton, patented a furnace in which fuel oil was conveyed into the furnace interior in a gaseous state. In 1863 a spray burner was introduced in America by Brydges Adams.

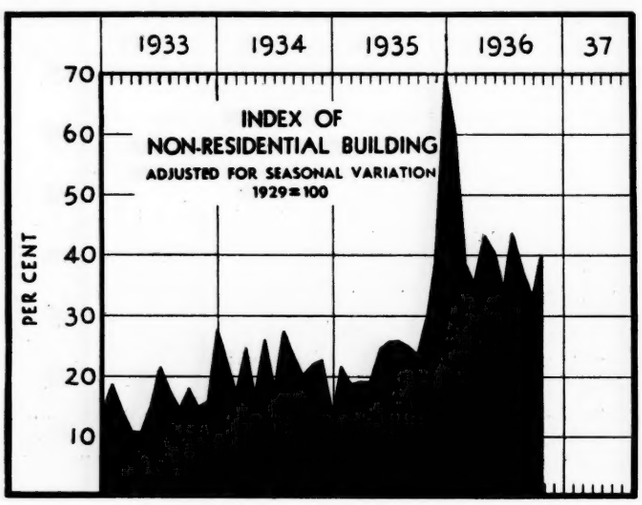
The idea of oil heat in the home was not new. The kerosene heating stove was in wide use, and efforts were constantly made to develop a satisfactory oil burner for home furnaces. There was—to name one of them—the attempt of a Russian named Baskakoff who in the early 1880's introduced a stove for house-warming which used oil fuel. It gave him the gold medal of the Imperial Russian Technical Society, but it never reached practical application. In 1890 or 1891 Raymond Greenwood was heating his house at Norristown, Pa., with oil, using a crude burner which he placed in a hot-air furnace, covering the burner with stones or broken fire bricks.

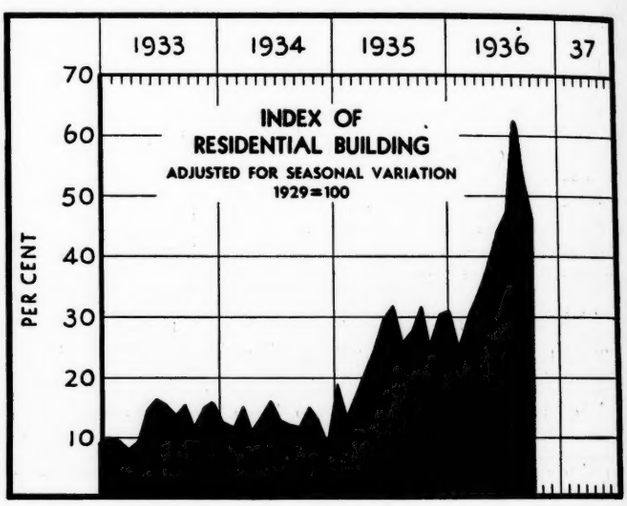
The real beginning of automatic oil heat in homes was not until 1917, however. Then the Americans, M. J. Hammers and C. L. Lewis, produced an electrically-ignited, fully automatic oil burner. They designed it originally to compete with the gas engine in automobiles and for stationary gas-engine application, as well as for use in firing household boilers and furnaces. Its first actual application was in a motor vehicle.—*Oil Burner Institute.*

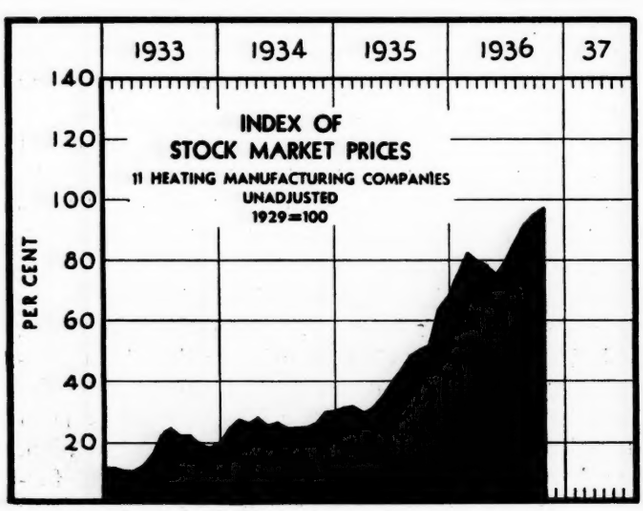
# HEATING BUSINESS TRENDS

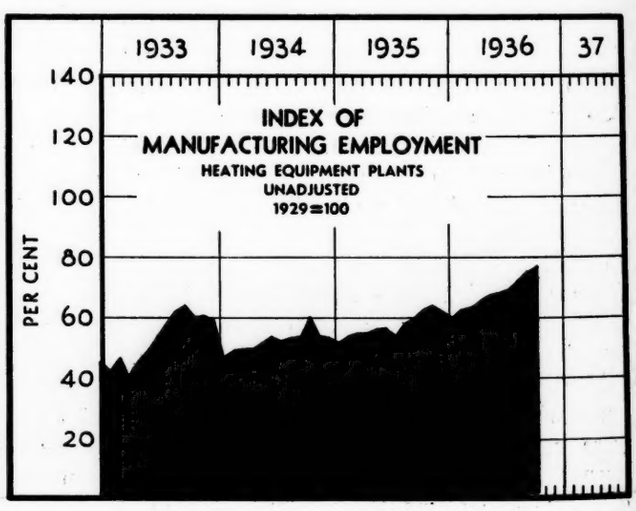


# Heating Business at 84% of 1929 Level; Office Buildings May Spend $8 Million for Air Conditioning

ACTIVITY in the heating industry during September, 1936, was at 84.3% of 1929 levels, according to HEATING & VENTILATING'S Index of Heating Business Activity. This compares with a level of 80.6% in August, 1936, and with 68.3% in September, 1935. The index is adjusted for seasonal variation.

Automatic heating business in September was at 172.4% as compared with 154.7% in August and with 122.0% in September, 1935.

Building contract figures as reported by F. W. Dodge Corporation continue at a highly encouraging rate. These contracts, in 37 eastern states, amounted to $79.7 million in October for residential building as compared with $87.0 million in September and with $55.1 million in October, 1935. Non-residential building contracts amounted to $79.1 million as compared with $69.1 million in September and with $59.4 million in October, 1935. Consequently, the combined index of all types of building adjusted for seasonal variation stood in October at 43% of 1929 levels as compared with 41% in September and with 31% in October, 1935.

Indications are that about 150,000 mechanical draft oil burners will be sold during 1936 as compared with about 110,000 in 1935, with natural draft burners running at approximately 1935 levels. Furnace burner units continue to gain and indications are that half as many of these as of boiler-burner units will be sold in 1936. Over 15,000 class one stokers were sold during September as compared with less than 9,000 in September, 1935.

Sales of non-ferrous convectors reached all time highs in August and September with sales amounting to over 550,000 sq. ft. in each month. Cast iron convectors reached their all time high in July with over 800,000 sq. ft. Similarly, non-ferrous indirect heating surfaces just missed reaching an all time high again in September by less than a thousand dollars, the record being $161,000 in April, 1936.

*Skyscraper Management*, the official organ of the National Association of Building Owners and Managers, recently conducted a survey of building owners and managers in order to determine the present status of air conditioning. Three hundred and sixty replies were received.

Of the replies received, 255 did not consider air conditioning in 1936 and do not have it in mind for 1937. In passing, it is interesting to note, however, that one of the 255 has since reversed himself and will install a system requiring an expenditure of over $100,000.

Of direct interest is the fact that 105 buildings are committed to a large expenditure for air conditioning. Thirty-five of those reporting will spend $2,798,600 in 1937. The editors estimate that the balance (approximately two-thirds), unable to give figures at this time, will bring the figure to well over $8,250,000.

A similar survey, made in the fall of 1935, revealed that $164,538.62 was spent that year on air conditioning. In 1936, the expenditure was $1,564,143.11.

**HEATING AND AIR CONDITIONING BUSINESS TRENDS**

| INDEXES (1929 = 100) (Seasonally Adjusted) | September, 1936 | September, 1935 |
|---|---|---|
| HEATING & VENTILATING'S Index of Heating Business | 84.3 | 68.3 |
| HEATING & VENTILATING'S Index of Automatic Heating | 172.4 | 122.0 |
| HEATING & VENTILATING'S Index of Contractor Activity | 65.1 | 55.6 |
| HEATING & VENTILATING'S Index of Heating Equipment Prices | 81.0 | 75.0 |
| **INDEXES (1929 = 100) (Seasonally Adjusted)** | **October, 1936** | **October, 1935** |
| HEATING & VENTILATING'S Index of Non-Residential Building Contracts | 40.3 | 30.2 |
| HEATING & VENTILATING'S Index of Residential Building Contracts | 45.8 | 31.8 |
| HEATING & VENTILATING'S Index of Stock Prices (Unadjusted) | 97.4 | 52.7 |
| HEATING & VENTILATING'S Index of General Business | 92.5 | 81.1 |
| HEATING & VENTILATING'S Index of Employment in Heating Equipment Manufacturing Plants | 76.5 | 63.1 |
| **EQUIPMENT SALES** | **September, 1936** | **September, 1935** |
| Mechanical draft oil burners, number of units | 29,492 | 23,175 |
| Oil burner-boiler units, number | 2,332 | 1,559 |
| Oil burner-furnace units, number | 1,027 | 594 |
| Blowers for public buildings, dollars | 133,362 | 67,322 |
| Small housed blowers, dollars | 155,310 | 51,267 |
| Propeller fans, dollars | 284,428 | 68,043 |
| Unit air conditioners, self-contained, dollars | 75,940 | — |
| Unit air conditioners, other, dollars | 359,941 | — |
| Central air conditioning systems, comfort, dollars | 341,696 | — |
| Central air conditioning systems, industrial, dollars | 34,177 | — |
| Refrigerating medium for air conditioning, dollars | 94,218 | — |
| Air filters, dollars | 14,952 | — |
| Humidifiers, dollars | 83,506 | — |
| Air washers, dollars | 36,217 | 14,870 |
| Unit heaters, dollars | 773,205 | 510,983 |
| Unit ventilators, dollars | 62,645 | 99,415 |
| Cast iron radiators, thousand sq. ft. | 9,190 | 7,701 |
| Steel boilers, square feet heating surface | 301,880 | 216,720 |
| Stokers, class one, number | 15,040 | 8,687 |
| Stokers, class two, number | 805 | 615 |
| Stokers, class three, number | 268 | 272 |
| Indirect heating surface, non-ferrous, dollars | 159,168 | 98,267 |
| Indirect heating surface, cast-iron, dollars | 17,392 | 4,099 |
| Non-ferrous convectors, sq. ft. | 553,449 | 245,244 |
| Cast iron convectors, sq. ft. | 749,825 | 441,948 |
| Round boilers, thousand pounds | 5,809 | 6,879 |
| Square boilers, thousand pounds | 33,549 | 31,761 |

# Gas Heating Progress During 1936†

By E. H. LEWIS‡

THE remarks which I have to make concerning house heating progress during 1936 relate only to the progress made by the company which I represent. I realize that different companies have widely diversified sales plans designed to meet conditions peculiar to the territories they serve. Some have operated on the campaign basis with frequent changes from year to year, while others have followed along one general pattern with only slight changes to meet changing conditions.

The St. Louis County Gas Company falls in the latter classification, and such progress as has been made during 1936 could be briefly summed up as simply an extension of activities carried on prior to that date. The company serves 43,900 customers, of which 42,200 are domestic. All of these are in suburban territory in St. Louis County, Missouri, which is largely residential in character and adjacent to the corporate limits of the City of St. Louis. Since 1932 we have supplied our customers with an 800 B.t.u. mixture of natural and manufactured gas. Prior thereto we distributed 570 B.t.u. carburetted water gas. In our locality a normal winter contains 4,525 degree days.

The present house heating rate includes an initial block at $1.05 per thousand cubic feet and the size of this block increases as building volume increases. The second, third and fourth steps of the rate are at 60c, 50c and 46c, respectively. These are gross rates and a small discount applies for prompt payment. Domestic usage is supplied through the same meter as the heating gas and all is billed at this rate. For a normally heated residence the average net rate for heating gas, after deducting domestic gas at the general rate, will run close to 60c per thousand cubic feet or 7½c per therm.

House heating customers, including some under contract but not connected as of October 1, total 3,301. When the customers now under contract are connected, house heating saturation will be in excess of 7½% of total customers. In the year 1935, 38% of our total sales of gas were to house heating customers. We estimate that for 1936 this figure will be increased to 45%.

The effect of heating sales on our revenue per customer is very pronounced. In 1935 our average revenue per residence customer without a heating plant was $29, from residence customers with heating plants $229, and from both combined was $39. This was accomplished with a heating customer saturation of less than 5%.

## Rates

The heating rate which has already been outlined briefly is a form of rate which has been used for house heating since 1919. During these years the size of the blocks and the charge per thousand cubic feet have been changed from time to time, but the fundamental rate form has remained unchanged and we feel that the rate has helped greatly in securing varying sizes and types of buildings at equitable average rates for the service. You will observe that the rate includes what some might call a radiation charge, although in this case it is based on the volume of the house. A customer with a poor load factor automatically pays a higher rate than the customer with a good load factor. This form of rate provides desirable customers with lower cost gas than rates which give no consideration to load factor.

## Sales Force

For more than ten years we have had a house heating force organized for the sole purpose of selling house heating. This force has been expanded from time to time and at no time since its organization have its activities been curtailed. The entire program of selling house heating is organized on the basis that every installation must be properly sold before it is placed in service. Careful estimates are made for every prospect by an engineering department which cooperates closely with the sales department but which is not under sales department direction. This is done even in cases where, prior to the preparation of the estimate, the prospect has decided to, or has actually installed gas heating equipment. At the present time the sales force is divided into two groups of salesmen, four to work with builders, architects and new house prospects, and six to convert the users of other fuels to gas.

## Competition

In the territory which we serve good bituminous coal sells for from five to seven dollars per ton and No. 3 oil for about 6½c per gallon. We do not consider coal, used either with or without a stoker, as offering a service which is competitive with gas. Oil does furnish a somewhat similar service but on the basis of total operating cost, including investment, depreciation, maintenance, etc., we have no difficulty in showing customers that we have the advantage with oil at any price close to six cents. This cost advantage, however, is not fully present where the customer has usable oil burning equipment. In such cases we have endeavored to present our story in such a way that, when trouble does develop on the oil burning equipment, customers will realize that it is then time to change to gas. Of course, some customers change before their oil burning equipment breaks down completely, but our sales program is laid out with the intention of presenting facts to oil burner users before they have trouble, so that when the trouble develops they will have already reached a decision and order gas heating equipment installed. This plan has the additional advantage of

†Abstracted from a paper delivered before the eighteenth annual convention, American Gas Association, Atlantic City, N. J., October 26-30, 1936.

‡Vice-President, The St. Louis County Gas Co., Webster Groves, Mo.

placing us in a position to make the installation of a gas burner quickly, sometimes in a matter of a few hours after the customer phones us his order. In such cases quick action is required, as you can bet the oil burner service man is on hand to take the customer's order for a new oil burner for immediate installation. This program of replacing oil burners has proved successful and we plan to increase our activities in this direction.

### Dealer Relations

Contractors and gas equipment sales organizations should form an important link in any sales program. I shall simply outline a few policies as we have applied them.

1. Dealers and contractors sell and install all gas designed equipment that is sold. Gas company salesmen receive load commissions and a bonus on such installations.
2. Gas company equipment sales are restricted to conversion burners, space and unit heaters and salesmen are paid a commission on these only if they file the prospects at the office before a dealer does.
3. Allowances are made for oil burners. Dealers make the same allowance for such equipment and are reimbursed by the gas company.
4. Dealer's time payment paper is handled on the same basis as gas company sales, and dealers may make the same guarantee as provided under the One Year Plan previously referred to when based on the company's estimated cost of operation.
5. The full resources of the estimating department are available to cooperating organizations.
6. Advertising has featured the advantages of, and general acceptance of gas for heating. Specific types of burners and equipment, prices, etc., are not referred to in gas company advertisements.
7. Cooperation is extended to organizations selling related products and to organizations with direct mail programs which can be used on a cooperative basis.

### Customer Contacts

No outline of house heating progress would be complete without stating that progress must not cease when a heating customer is secured and the installation completed. Heating customers should be completely informed concerning various matters relating to the heating of their homes. We usually contact our heating customers once or twice a year with some form of direct-mail material, usually of a service type. Customers are given information concerning the Degree Day as the unit for measuring fuel requirements and every gas bill that is mailed out has stamped on it the number of degree days in the period covered by the bill. A tabulation showing degree days for preceding years by months and for a normal year is regularly carried on the bills during the heating season.

A consistent program carried on over a period of years of educating customers to the use of this degree day data in comparing bills for one month with another has gone a long way toward eliminating high bill complaints and has made it easier to handle such complaints as have arisen. It is not unusual to hear the users of gas in our territory discussing, in their social and business contacts, degree day data and its effect on their consumption of fuel. I recommend some such plan to you if you do not already have one in effect.

### Servicing Customer Installations

While servicing customer installations is not directly a selling function, nevertheless, it is an important part of any program to promote the use of gas for heating. We believe it is our duty, as well as good business for us, to carefully check up and test out every new gas heating installation put on our lines, whether the equipment is sold by our company or others, before that installation is placed in service, to see that it is placed in operation in a satisfactory manner for the first time, and for thirty days follow up its operation to see that it functions in a satisfactory manner. This does much to insure a satisfied customer. Following this, one inspection of each heating customer's equipment is made once during the heating season, without charge, at which time minor adjustments are made. All other service is charged for except calls made necessary by failure of equipment during the guarantee period. We have built our heating business on the basis that the customer must pay for servicing and cleaning his equipment and we are now glad we have refrained from employing a policy of unlimited free service, which we feel leads to abuses, resulting in excessive servicing costs.

### The Record

Approximately two-thirds of our contracts in 1935 and 1936 covered brand new houses and practically all of them were equipped with gas designed equipment. And what should be of particular significance to the equipment manufacturers is that last year over 80% of these gas installations in new homes were of the warm air type and this year over 95% were of this type.

In 1935 we signed up heating contracts with 658 new customers. Of these approximately 400 covered new houses. In nine months of this year we have signed up 699 new heating customers, of which approximately 440 were in new houses. For the full year of 1936 we expect to secure not less than 900 new heating contracts or increase our saturation by more than 2%. This will be twice the number secured in 1934 and the increase is largely accounted for by the increase in the number of new buildings erected in our territory.

We have been fortunate in being in a territory that is building up rapidly and in having the opportunity presented to us of taking on a large volume of heating business in newly-constructed homes. At least we can take credit for taking advantage of the opportunity when it presented itself, by first, having a gas rate that made it possible for us to successfully compete for this business with other fuels; second, by having public acceptance of gas heating established in our territory through an advertising and sales program consistently and continuously carried on over a period of years; third, by having established a satisfactory dealer relationship through years of cooperation; and last, but not least, by having in the field an experienced, well paid, and competent force of salesmen to present our story to the public.

# The Mechanical Stoker—Its Development and Progress

By MARC G. BLUTH

**The author, who is executive secretary of the Committee of Ten—Coal and Heating Industries, spoke before the 44th annual meeting of the Illinois Mining Institute, October 23. His subject was "The Coal Industry's New Opportunity," and although his remarks were addressed to the coal industry, much of his talk is of interest to heating men in general. We present here abstracts from Mr. Bluth's paper which deals directly with problems bearing on matters of concern to our own industry.**

THE small mechanical coal stoker was not known until about fifteen years ago. It was pioneered out on the Pacific Coast thousands of miles from large consuming coal markets and was gradually brought into this market after a few years of fairly successful operation in the west. In those days coal operators in the Rocky Mountain fields suffered terribly from a lack of market for their 2-in. and 1½-in. screenings. They had a good market for prepared coal sizes for hand firing but for many years dumped hundreds of thousands of tons of screenings in each of these fields because they did not have a demand for their 2-in. and 1½-in. screenings. The small stoker came along. True, it was a crude affair compared with the present day automatic coal burner but it was something different. It was new and as sales of the small machines increased, it helped the operators in those fields move an increasing tonnage of screenings. The small stoker was brought into the middle west and the east. It was also introduced into the anthracite territory. A few far-sighted coal operators and retailers in the middle west invested their money in stoker plants and manufacturing facilities because they believed it promised a future not only to enhance their own pocketbooks but because they were beginning to lose tonnage to oil and gas and this machine apparently had the earmarks of something that would meet that competition.

So we bring the stoker up to the present day. What do we find? 1935 sales of stokers of all sizes and kinds for burning of all kinds of coal—bituminous, anthracite and lignite—were the largest in the history of the industry. Oil burners, even in spite of being a record year in 1935, sold in the ratio of only 3½ to 1 as compared to stokers. This year we more or less expect a sales volume of about 100,000 units, double 1935 business. The big market for bituminous stokers is in the territory comprising Illinois, Wisconsin, Michigan, Ohio, Pennsylvania, Indiana, Iowa, Minnesota, Missouri, and Nebraska. Over 42% of the stokers sold last year were sold in this territory, according to a survey which our organization made the first of this year. These sales are being made to plants in every industry; to commercial structures of all kinds; and thousands and thousands to homeowners and apartment building owners.

Small stokers have been and at the present time are being represented as and sold as basic units. However, the stoker is not a basic unit. It can only be used in connection with a heating or air conditioning system. The performance of the boiler and the heating system determines almost entirely what may be expected from the stoker. Stoker manufacturers are now taking steps to combine with their machine a boiler or furnace as an integral part of the modern heating and air conditioning system. This is being brought about by the knowledge that we have been woefully weak in applying to new homes and modernized buildings modern equipment that places coal on an equal basis with competitive fuels. The combined unit today offers not only to the stoker manufacturer a new opportunity to present his equipment to the prospective buyer in a very favorable light but it offers to the coal industry a new opportunity to cooperate with the stoker manufacturer and allied organizations in showing the public that coal is an automatic fuel; that it is clean; that it can be made dustless; and that an architect or a builder can offer to his clients attractive equipment all in one single unit.

Upon the coal industry's shoulders, along with the stoker people and manufacturers and designers of boilers and furnaces, falls the responsibility of driving home to the consumer the plain fact that coal is an ideal fuel when used with equipment adapted for its use. We are facing in this country a nationwide building and modernization boom. Surveys made have shown definitely that stokers as a general rule have not been installed in new homes now being built. This indicates that buying methods have changed. Modern systems of different types have been designed and the entire plant is purchased at one time, which has done more than any other single factor to raise the standard of home heating. We can compare this with the purchase of an automobile today. Not so many years ago when we bought new automobiles, it was necessary to go to another store to buy a set of bumpers. All the other accessories were handled by different dealers. Today an automobile is sold as a single unit. Everything is attached The spare tire is included. You can walk into a display room of an automobile dealer in the morning, order a new car, and that afternoon drive

it out completely equipped. That is the trend in heating equipment today, and it presents to the coal industry its real opportunity to share and to keep its business as this lusty building industry continues on its way up. Without this equipment we cannot hope to maintain our competitive position in this most important market.

Manufacturers and distributors of coal-burning equipment are beginning to realize its importance but I am deeply disturbed when I learn that a survey conducted by an independent, reliable agency disclosed that of 500 new homes built this year in an eastern city only two were constructed so that coal could be used as the fuel. A check of 75 homes in Detroit shows that not one single stoker installation was made. In 117 new homes built in Madison, Wis., this year, only one coal bin was specified. In 600 new homes built in Milwaukee during the last two years, only 25 coal-burning boilers and stokers were installed. In the city of St. Paul in 1935 over 1000 oil burners were installed and most of these were combined boiler-burner units. I have kidded myself during the past few years, and others in the industry have also kidded themselves, that an oil burner installation or a gas burner installation is easy to convert to automatic fired coal when the sales presentation is properly made. I must confess that this opinion which I held has been knocked into a cocked hat. Why? People don't buy oil burners or gas burners for economy. They buy for convenience, comfort, cleanliness, and sometimes from sheer downright laziness.

All of this discussion is incidental to your main problems. Acknowledging that the consumer is the final judge, let us look back a few years to see what effect the installation of small stokers has had on the production and preparation of coal. A statement which came into my hands about eighteen months ago showed that there was a large increase in the percentage of fine coal and a corresponding decrease in the percentage of lump coal from mines in Indiana and Illinois. The trend nationally is definitely toward increasing production of small sizes adapted for use in mechanically-fired equipment and this development is continuing to have a greater bearing on the economic and commercial status of the coal industry. Undoubtedly, it means that a readjustment will eventually be made in the price structure of bituminous coal both at the mine and delivered in the consumer's bin. The revenue from the sale of fine sizes will automatically be increased to offset the declining revenue due to the decreased sale of lump and coarse sizes which ordinarily command a higher price in the consuming markets.

Now some people might say that this is alarming to the stoker industry because sales of thousands of stokers have been based on its economy appeal and in most of these cases on the difference between the delivered price of prepared sizes as against the smaller sizes for stoker use. But the stoker manufacturer today is placing his greatest emphasis on the convenience of automatic coal heat and he can do this and is doing it because the equipment is gradually being perfected to afford completely automatic heat. Along with the coal man he is right up against the competition of other fuels, but we are witnessing the gradual rise in the price of oil as a heating fuel. A balance can be and will be maintained between the prices of these competitive fuels that will make it possible now and in the future to keep coal in its present competitive position regardless of the increasing demand for stoker size coal as the stoker industry correspondingly increases its volume.

One exceedingly live subject today is the proper size of coal to be used in small mechanical coal-burning stokers. This subject is being discussed in every coal producing field of the United States, and not only discussed but "cussed" by retailers and consumers in many markets who are floundering because of the lack of authoritative and unbiased information on the proper size or sizes or character of coal for stoker use. I do not believe that it is an impossible situation. I do not concur with some who think that some standardization of coal sizing for stoker use cannot be accomplished. I do state and have stated many times that it is necessary to correlate information and opinions from each coal producing field in order that the problem can be better understood before starting any activity in this direction.

An examination of a few phases of the problem might be helpful: stokers differ in type; stoker types differ in characteristics as sizes change; moreover there are about 250,000 to 300,000 stokers in service today. Many of these are of antiquated design so proportioned and installed as to require selected fuel. There is as much difference in old stokers of the same type and size as made by various manufacturers as there is between a modern high priced car and some of the early automobiles which are now obsolete.

Some of the factors involved in sizing stoker coal from the utilization viewpoint are worth consideration. They are:

**1.—Steam or heating requirements of the fuel buyers.**
**2.—Character, condition, or operation of the plant as well as the mechanical stoker itself.**
**3.—Geological location of the fuel user.**
**4.—Competitive fuel prices.**
**5.—Psychology of the buyer or user.**
**6.—Freedom of choice of various fuels, relative desirability and adaptability for a particular requirement—real or imaginary.**
**7.—Relative ignorance and indifference as well as something of the irresponsibility on the part of some sellers to the buyer as well as the fuel user to the public as to smoke or air pollution.**
**8.—Operating characteristics of various fuels which influence the choice of a particular coal or a special size—to avoid certain use or operating factors such as**

**(a.) Excess amount of fines requiring extra power to operate some stokers and higher pressure of forced draft fan.**
**(b.) Variation in coal sizes due to inability to duplicate deliveries—difficulty in adjusting for uniform air to coal ratio.**
**(c.) Excess amount of dust or dirt in delivery or otherwise.**
**(d.) Excess ash.**
**(e.) Segregation of sizes.**
**(f.) Noise of coal crushing with small underfeed stokers due to the use of larger sizes and requiring more power to operate the stoker.**
**(g.) Hopper smoke due to too large percentage of coarse sizes.**
**(h.) Dense fuel beds due to abnormally fine coal with formation of occasional blow holes resulting in concentrated high temperatures and resultant clinkers.**
**(i.) Excessive fly ash through use of coal with a too high or too low percentage of small size.**

The right size of a given coal for any one stoker installation is easy to determine but to prescribe sizes to

cover a field, taking into account various types, designs and vintage of stokers and embracing those built by inexperienced designers and manufacturers is truly a complicated problem. To this problem must be added the various classes of coal available with the producer's and retailer's problems of cost, disposal of other sizes, special equipment and preparation. The problem, however, does lend itself to some analysis and by studying all of the elements, some average solutions may be worked out in planning for the future. It may be possible to establish a trend toward certain sizes as mine equipment will permit and economic factors dictate.

Small stokers having a capacity of 100 lb. of coal feed per hour or less present the most troublesome sizing problems. Here price, while a factor, is not the entire problem nor the major problem, and is limited only by the price of competitive fuels. Cleanliness, comfort, and convenience are very important. Noise is a nuisance. Power is important. Fuel for the small underfeed stoker must be separately considered from stoker sizes for other types and sizes of machines; particularly those stokers operated in industrial and power plants. In this classification there are three classes of small stokers to consider: first, old stokers installed before stoker design, building, and installing had reached the fine art that it is today; second, stokers of unbalanced design being built and installed by some companies untrained and inexperienced in stoker engineering and manufacture. Third, stokers built and installed by companies spending money and time on research. Such companies help both the stoker and coal industry. It is inevitable that only such companies can eventually survive. As the result of such research, 1936 models have, and 1937 models will have, more latitude than ever before in the matter of coal sizes and quality.

## Dust Control Devices Tested

TESTING of dust control machinery to be used in the New York State's Labor Department's campaign for the prevention of silicosis and the removal of dust disease hazards in industry was begun recently at a field laboratory established by the Department in a granite outcropping in Letchworth Village, Rockland County, New York.

The tests are being conducted under conditions and procedures recommended by the advisory committee on dust control rules and regulations for rock drilling operations. This committee has conducted several meetings at which it has drafted rules and regulations to be reported to the Industrial Board for inclusion in the Industrial Code. While the recommendations of the committee will not become a part of the Code until adopted by the Board after a public hearing, and until approved by the Industrial Commissioner, testing of the dust control devices under these provisions was begun so that promptly on their former inclusion in the Code, the Labor Department may approve devices which have passed tests.

The testing procedure for approval of dust control devices for rock drilling as adopted by the committee includes among other provisions:

The application for approval of a device must state full particulars with respect to the capacity and limitation of the apparatus including the following items: (1) number and size of drills with which the equipment is to be used; (2) drilling position—down drilling, drifting, stoping (at an angle greater than 60° with horizontal); (3) rate of air flow through each exhaust hood (cubic feet per minute), and the rate through the entire apparatus; (4) pressure-volume characteristic curve of the suction devices; (5) total resistance to air flow through the apparatus in inches of mercury (apparatus in operation); (6) horsepower of the driving motor; (7) dust storage capacity of the various stages of collection in the dust-separator; (8) estimated percentages of the total dust collected which is removed by each stage of separation; (9) net filter area in the dust-separator; (10) water pressure at the drill (in the case of wet drilling); (11) other basic specifications that may be required to insure proper operation of the equipment to be tested.

Each applicant must furnish and install at the Rockland County testing field the drills, compressor, piping and other essential equipment and also furnish the drill operators, compressor engineer, and all other workmen required to operate the drilling equipment and dust control equipment during the test period. The Labor Department furnishes testing engineers and assistants to conduct the test, make the necessary measurements and furnish all testing instruments and the water.

Tests require the use of the following drilling equipment: down drilling, jack hammer, 2⅝-in. bore, 1-in. hollow drill steel, 2½-in. starting gage; drifting, 3½-in. bore for drifter, 1¼-in. hollow drill steel, 2⅛-in. starting gage; stoping, stope hammer, power rotating, 2⅝-in. bore, 1-in. hollow steel, 1¾-in. starting gage.

The compressed air pressure at the drill during the tests must be 80 lb. per sq. in. with a variation of 2½% in either direction allowable. Holes are to be drilled approximately the following depths: Jack hammer, eight feet; drifter, eight feet; stope hammer, six feet. The overall rate of drilling is to approximate 15 ft. per hr. for the jack hammer; 20 ft. per hr. for the drifter, and 12 ft. per hr. for the stope hammer.

For dust control equipment of the exhaust type the test period consists of two 3-hr. shifts, one in the forenoon and one in the afternoon. During each shift the equipment is in operation for 1 hr. before collection of atmospheric dust samples is made. Three such samples of 15 min. each are collected during the last two hours of each shift, the samples being taken at the breathing level of the drill operator within the enclosure wherein the drilling is being done. The impinger dust sampling method is used and the method of analysis is the light-field, low power microscopic technic or its equivalent.

For dust control equipment employing water or other liquids, "wet drilling," the test period consists of one 3-hr. shift. The sampling of atmospheric dust is similar to that for the exhaust type of equipment.

# Underwriters' Regulations for Installation of Ventilating and Air Conditioning Systems

THE National Board of Fire Underwriters in 1929 issued its well known regulations covering installations of blower and exhaust systems. Changes have now (October 15) been made in these regulations bringing them up to date, although the scope and provisions are similar to those in the previous edition. In order to make the title more descriptive of the conditions the title has been modified.

In these regulations the word "approved" is used as meaning acceptable to the inspection department having jurisdiction and means installed in accordance with regulations of the National Board of Fire Underwriters pertaining thereto, and when referring to appliances means tested and found suitable for installation and use.

The regulations are divided into three main parts, part A of which relates to air conditioning and ventilating systems. That part of the regulations is printed here in full as follows:

101. These regulations are submitted as a guide for the proper installation and safeguarding of these systems, taking into consideration the purpose for which they are intended and the functions that they are designed to perform. The object of these regulations is to eliminate or reduce the known fire and explosion hazards inherent in the operation of these systems and to prevent them from becoming the means of spreading fires.

It is not the intent herein to specify any standards for portable exhaust equipment, nor to deal with natural ventilation, nor with equipment not connected to a permanently installed duct system, all of which types, however, have their field of usefulness.

102. The design and installation of systems coming within the scope of these regulations should be in the hands of competent engineers and their maintenance and operation should be in charge of reliable and experienced persons.

103. In the regulations for specific industries or operations there will be found special requirements not embodied in these regulations, or modifications of certain of these requirements.

104. These regulations are divided, in their application, into the three following classes:

A. Air Conditioning and Ventilating Systems.

B. Systems for the removal of flammable vapors and residues.

C. Systems for the removal or conveying of dust, stock and refuse materials.

## General Requirements

110. These general requirements apply to all systems, except as modified or amplified by the specific rules in the various classes enumerated or in the special rules applying to specified industries.

**120. Power, Lighting and Control.**

121. All Electric equipment shall be installed in accordance with the National Electrical Code. Fans should preferably be electrically unit driven. The installation and the selection of the type of motor suitable for the specific conditions shall be subject to the approval of the inspection department having jurisdiction.

122. Motors shall be located outside of rooms in which flammable vapors (Class B) or flammable dust (Class C) are being generated and removed, unless of the type approved for the particular conditions or hazard. Where necessary to install lights, switches, or control fans in atmospheres presenting explosive possibilities, only such equipment as is approved for the specific conditions obtaining shall be used.

123. Remote control for all blower or exhaust fans shall be provided, in addition to any control located close to the equipment or within the room involved. Consult the requirements of the various classes for further details concerning control. Service or feeder switches, controlling the fan, may fulfill this requirement when conveniently located and approved by the inspection department having jurisdiction.

**124. Power Transmission.**

(a) When other than unit electric drive is used, the transmission of power to fans located within rooms or enclosures from which flammable vapors are being removed shall be by means of shafting equipped with close fitting bushings where penetrating the room wall.

(b) In the case of rooms or enclosures from which flammable dust is being removed, shafting as above specified, or belts, chains or similar driving mechanism may be used, providing they are encased in dust-tight enclosures constructed of substantial noncombustible materials on both sides of the wall or partition pierced.

**130. Fans.**

131. The term "fans" as used in these regulations refers to the assembly comprising the blades or runners and housings or casings and includes both blowers and exhausters.

Blowers are fans used to force air under pressure into the affected areas.

Exhausters are fans used to withdraw air, gas or solid materials (dust, refuse and stock) from the affected areas under suction.

132. Fans shall be of non-combustible construction and of adequate capacity to properly perform the functions required, but excess capacity is undesirable as a producer of unnecessary drafts and should be avoided except where justified by the contemplated extension of operations.

133. When installed, fans shall be so located and arranged as to afford ready access for repairing, cleaning, inspection and lubricating. They should be placed on proper foundations or firmly secured to substantial supports.

134. Housings or casings shall be of substantial construction to prevent distortion and loss of alignment under operating conditions.

135. Blades or runners shall be sufficiently strong to prevent contact

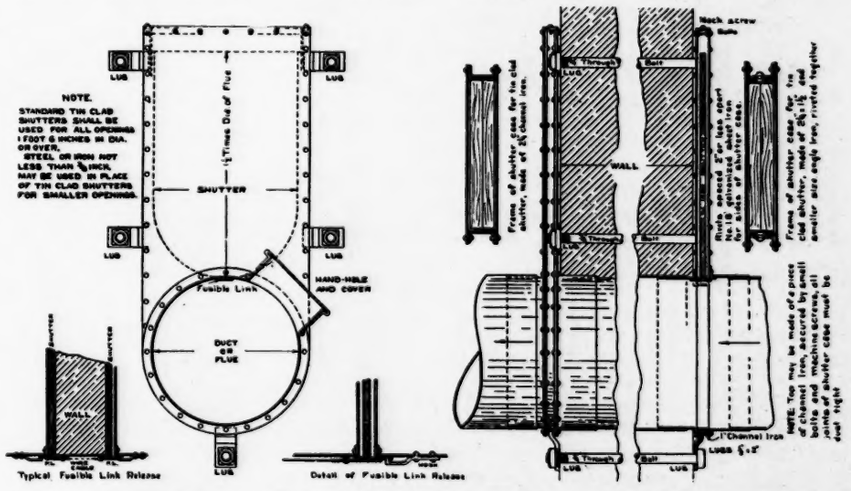

NOTE.
STANDARD TIN CLAD SHUTTERS SHALL BE USED FOR ALL OPENINGS 1 FOOT 6 INCHES IN DIA. OR OVER. STEEL OR IRON NOT LESS THAN ¼ INCH, MAY BE USED IN PLACE OF TIN CLAD SHUTTERS FOR SMALLER OPENINGS.
1½ Times Dia of Flue
LUG
SHUTTER
Fusible Link
HAND-HOLE AND COVER
DUCT OR FLUE
WALL
Typical Fusible Link Release
Detail of Fusible Link Release
WALL
Mach screw
Bolt
Frame of shutter case, for tin clad shutter, made of 2½ x 2½ x ¼ angle iron, riveted together
Rivets spaced 3" on bolt apart No.10 galvanized steel iron for sides of shutter case.
Frame of shutter case for tin clad shutter, made of 2½ x 2½ angle iron, spaced 3" on bolt apart
Channel iron
Lugs 5 x 5"
NOTE. Top may be made of a piece of channel iron, secured by small bolts and machine screws, all joints of shutter case must be steel tight

*Fig. 1. Suggested type of vertical firedoor for duct passing through opening in firewall.*

with casings or distortion under conditions of deposit loading or other operating factors.

136. Exposed openings into housings shall be protected with substantial metal screens or gratings to prevent accidents or the entry of foreign material.

137. Bearings shall be constructed in accordance with the best modern practice and shall be so proportioned, secured and aligned as to prevent overheating. Bearings shall be self-lubricating and shall be well designed to prevent leakage of oil and minimize dust infiltration. They should be located outside of casings and ducts wherever possible and shall be so located where specifically required in these rules.

**140. Ducts.**

141. The term "ducts" shall refer to tubes, passages, or other channels used for the purpose of conveying air, gas, dust, refuse or other materials by means of blower or exhaust systems.

142. Ducts may be of independent construction or a part of the building structure, except where the latter arrangement is prohibited by the class requirements.

143. They shall be constructed entirely of non-combustible material, such as iron, steel or other approved material.

144. The entire duct system should be self-contained. No rooms or portions of the building shall be used as an integral part of the system unless of non-combustible construction, and such design and arrangement shall be subject to the approval of the inspection department having jurisdiction.

145. All ducts shall be made reasonably tight throughout and shall have no openings other than those required for the proper operation and maintenance of the system.

146. Ducts shall be constructed of adequate strength and thickness to meet the conditions of service and installation requirements, and shall be properly protected where subject to mechanical injury. Minimum thicknesses for metal ducts are specified under the respective classes.

147. All ducts shall be thoroughly braced where required and substantially supported by metal hangers or brackets. Where ducts are used for conveying explosive gases or dust, the supports shall be designed to afford strength and rigidity against disruption. All laps in the piping should be made in the direction of the air flow.

148. Changes in size of ducts in Class B and Class C installations shall require a taper at least five inches in length for each one-inch change in size.

149. The passing of ducts through fire walls should be avoided wherever possible. When ducts or the outlets from or inlets to them pass through fire walls, they shall be provided with approved automatic fire doors on both sides of the wall through which they pass. (See Figs. 1 and 2.) On small openings not exceeding 18 inches in diameter, ⅜-inch steel plates may be used in lieu of fire doors.[1]

150. In no case shall the clearance from metal ducts to stored materials be less than six inches, and to combustible construction it shall not be less than ½ inch.

151. Where ducts pass through floors or partitions the space around the duct shall be sealed with rope asbestos, mineral wool or other non-combustible material to prevent the passage of flame and smoke.

152. Hand holes, for damper inspection or resetting and in the case of Class B and Class C systems for residue clean-out purposes, shall be equipped with tight fitting sliding or swinging doors provided with substantial latches, except in the case of vertical sliding doors.

**160. Protection against Static Electricity for Classes B and C.**

161. All metal parts of apparatus, used in systems for the removal of flammable gases or vapors, or systems used for conveying combustible or flammable dust, stock or refuse, considered in these requirements, including fans, ducts, etc., as well as shafting in connection therewith, shall be electrically grounded in an effective and approved manner.

162. When metallic contact is broken at duct joints or at other points on the installation assembly, metallic straps, preferably of copper, shall be installed where necessary to afford effective electric grounding connections.

163. Belts shall be grounded by means of copper collectors or "combs" connected to insulated wires, of adequate size, carried to ground.

**165. Fire Extinguishing Apparatus, Automatic or Manual.**

166. The provision of extinguishing equipment for systems handling combustible materials or flammable vapors should be subject to the approval of the inspection department having jurisdiction.

167. Where automatic sprinklers are required in conveying systems handling combustible material, there shall be approved sprinkler heads near the feed end and at the discharge outlet, inside the condenser, cyclone or separator if such is used and also a sprinkler to protect the blower. In cyclones or conveying apparatus outside of building, sprinklers may be manually controlled. In some cases, sprinklers may be installed inside the ducts. Such sprinklers should be arranged in an offset or dome shaped casing and not in the direct path of the draft.

168. In systems for the removal of flammable vapors or gases, the use of inert gases for fire extinguishing purposes is recommended. These extinguishing mediums may be controlled either automatically or manually, as required.

169. Where vent systems for cooking equipment are installed, the provision of steam jets, if available, or an inert gas extinguishing system, is recommended.

170. Vaults containing accumulations of shavings or other combustible materials should be protected by approved automatic sprinklers or, where not available, steam jets or other approved fire protection may be used as required. Approved hand hose located conveniently outside the vault may also be installed to advantage.

171. An adequate equipment of first-aid fire appliances shall be provided. (See Regulations for First Aid Fire Appliances.)

## Class A.— Air Conditioning and Ventilating Systems

**201. Application and Scope.**

(a) These regulations apply to air

[1]A fire wall is defined in the Building Code recommended by the National Board of Fire Underwriters as "a wall which subdivides a building or separates buildings to restrict the spread of fire and which starts at the foundation and extends continuously through all stories to and above the roof."

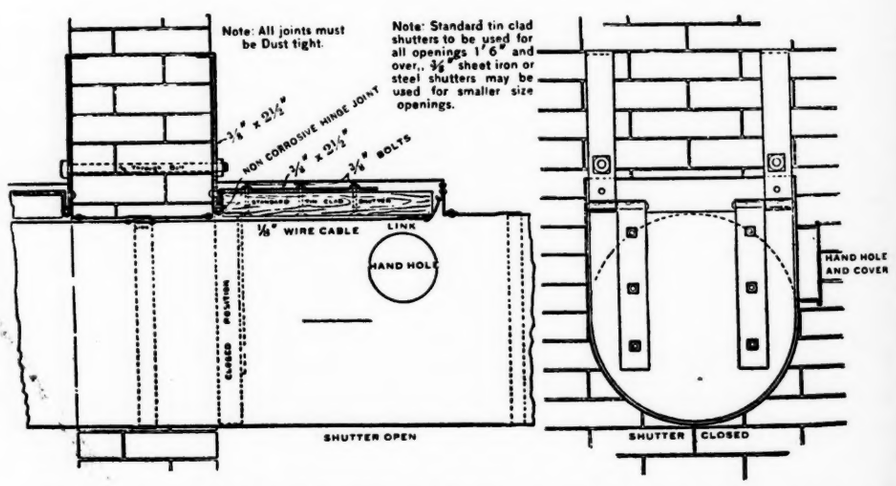

Note: All joints must be Dust tight.
Note: Standard tin clad shutters to be used for all openings 1'6" and over,, 1/16" sheet iron or steel shutters may be used for smaller size openings.
NON CORROSIVE HINGE JOINT
BOLTS
1/8" WIRE CABLE
LINK
HAND HOLE
HAND HOLE AND COVER
SHUTTER OPEN
SHUTTER CLOSED

*Fig. 2. Suggested type of automatic hinged firedoor for duct passing through opening in firewall.*

duct systems employing mechanical means for the movement of air and for heating and ventilating, including warm air heating systems, plain ventilating systems, combination heating and ventilating systems, air cooling systems, air conditioning systems, and exhaust systems. They do not apply to systems which carry air containing flammable substances (covered in Class B) nor to systems for conveying stock or refuse by means of air currents (covered in Class C).

(b) Where systems of this class are installed, the following rules and the preceding general rules shall apply except as modified herein.

(c) Installation of systems of this class in one- and two-family dwellings shall be as specified in Section 280.

**210. Construction of Ducts.**

211. Flexible woven asbestos, sleeve joints with rope asbestos packing or other approved non-combustible material shall be provided where flexible connections to prevent transmission of vibrations through the duct system are desired. This requirement does not apply to the joint connecting fans, where the intake or discharge of the fan is in the same room or enclosure as the joint.

212. Only fire-resistive linings acceptable to the inspection department having jurisdiction may be used inside of ducts.

213. Ducts shall be so constructed as to provide structural strength and durability at least the equivalent of galvanized sheet iron or steel of the thickness specified in Table 1.

TABLE 1.—THICKNESS OF METAL FOR AIR DUCTS

| Round Ducts Diameter (In.) | Rectangular Ducts Width (In.) | Minimum Thickness U.S. Gauge |
|---|---|---|
| 6 to 10 | Up to 12 | 26 |
| 11 to 29 | 13 to 30 | 24 |
| 30 to 39 | 31 to 60 | 22 |
| 40 to 49 | 61 to 118 | 20 |
| 50 and above | 119 and above | 18 |

**220. Installation of Ducts.**

221. Ducts which pass through floors of "fireproof construction," "semi-fireproof construction" or heavy timber construction, in which vertical openings are generally protected, shall be incased in 4-inch hollow clay tile, 4-inch gypsum block or their equivalent. Such construction, however, shall not be required for branches which are cut off from the main portion of the duct by approved fire dampers.

222. The use of an attic or concealed space as part of a duct system shall be prohibited, except when it conforms to all of the requirements for duct systems. This, however, shall not be construed as preventing the use of such space for the location of plenum chambers, where such plenum chambers conform as to construction with other portions of the duct system as herein required. The chambers shall not be used for storage or occupational purposes.

223. Ducts shall not be built into a building in such a way as to impair the effectiveness of the fireproofing around steel or iron structural members, such as placing ducts between the fireproofing and the members protected.

224. Systems in which a flammable or an irritant refrigerant as defined in §271 is employed, shall have refrigerating machinery located in a room cut off from other portions of the building by construction having a fire-resistive rating of not less than one hour. Such rooms should be as small as practicable to discourage their use for storage purposes.

225. Ducts should not be located where they will be subject to damage or rupture. Where so located they shall be suitably protected.

226. Where ducts pass through concealed ceiling spaces of combustible construction or are located inside combustible partitions or walls, either the ducts or the interior surfaces of such concealed ceiling space, partition or walls shall be protected with ¼-inch asbestos or other approved insulating material or a clearance of ½-inch as specified in Rule 150 shall be maintained between ducts and all combustible construction. The integrity of fire-stopping shall not be destroyed. The spaces between the ducts and the fire-stopping shall be filled solidly with brick, asbestos, mineral wool or other approved non-combustible material.

**230. Automatic Fire Doors and Dampers.**

231. Fire dampers installed in the system, as required at other than fire wall openings, shall be No. 16 U. S. gauge metal on ducts up to 18 inches in diameter or greatest width, No. 12 U. S. gauge on diameters up to 36 inches or greatest width and No. 7 U. S. gauge on ducts above 36 inches in width. One-half inch approved rigid asbestos sheet material may be used at points where metal dampers are specified, when permission of inspection department having jurisdiction is granted.

232. Fire dampers shall be arranged to close automatically and remain tightly closed, upon the operation of a fusible link or other approved heat actuated device located where readily affected by an abnormal rise of temperature in the duct. Hinged dampers shall be equipped with spring catches and pins of hinges shall be of corrosion resistant material.

233. An approved fire damper shall be provided on each opening through a required fire partition.[2]

[2]A fire partition is defined in the Building Code recommended by the National Board of Fire Underwriters as "a wall or partition which subdivides a story of a building to restrict the spread of fire or to provide an area of refuge," and to be so classed must have a fire resistance rating of not less than two hours. A required fire partition is one which is required by the provisions of said building code or by the regulations applying to some specific occupancy.

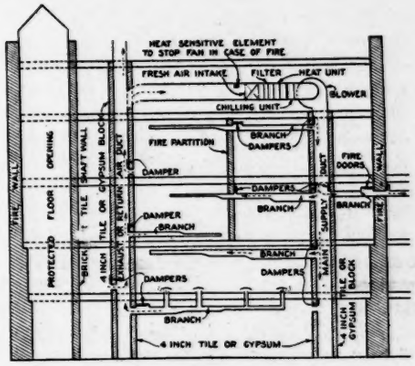



*Fig. 3. Typical installation of air conditioning system, in building of "fireproof," "semi-fireproof" or heavy timber construction. See Figs. 1 and 2 for type of dampers and firedoors.*

**234. When ducts pass through floors and serve more than one story, approved fire dampers shall be provided at all outlet and inlet openings or branches to or from such main vertical ducts.**

235. Outside air intake openings shall be protected with approved automatic fire doors or shutters, except where permission to omit them, because of light exposure, is granted by the inspection department having jurisdiction. When deemed necessary by inspection department having jurisdiction, approved heat actuated devices shall be installed at intake openings to shut fans down in case of exposure fires.

236. Fire doors at openings through fire walls and fire dampers at fire partitions shall be so arranged that the disruption of the duct will not cause failure to protect the opening.[3]

**240. Air Intakes and Outlets.**

241. Air shall not be re-circulated from any space in which objectionable vapors, flyings or dust are given off.

242. When located less than seven feet above the floor, air inlet and outlet openings shall be protected by a substantial grille or screen of one inch or smaller mesh.

**250. Air Filters.**

251. Air filters of combustible materials shall not be used unless adequately flameproofed by chemical or mechanical means, provided such means does not produce a compound generating toxic gases under heat conditions.

252. Flameproofed materials shall be such approved materials as have satisfactorily been subjected, under operating conditions, to 40 minute test with flame regulated to give temperature indications according to the stand-

[3]This may be accomplished by locating the fire door or damper in a collar securely fastened to the wall as shown in Figs. 1 and 2.

ard time temperature curve; the flame touching the test sample during the entire period. No sustained flame shall issue from the sample. Any flame which occurs shall be limited to intermittent short flames from the area directly exposed to "the test" flame. No flaming shall occur more than 2 minutes after the test flame is discontinued.

253. Liquid adhesive coatings used on air filters shall have a flashpoint not lower than 350° F., Cleveland open cup tester.

254. Oil tanks into which removable filters are dipped should preferably be located outside the building or in a separate fire-resistive room. Such tanks shall be of metal, equipped with tight fitting covers and shall be kept tightly covered when not in actual use.

255. Where filters are flushed with oil flowing through the air stream the system shall be arranged so that the filters cannot be flushed while the fan is in operation.

**260. Controls.**

261. In systems which serve more than one story of a building or more than one fire section of a single story, fans shall be arranged to shut down automatically when the temperature of the air in the system becomes excessive, as from a fire. For this purpose an approved resetting thermostatic device shall be located in the system at a suitable point close to the fan.

**270. Air Cooling and Heating Equipment.**

271. Coils carrying refrigerants which are flammable or which are classified by Underwriters' Laboratories in toxicity classification Groups 1 to 4 inclusive, shall not be placed in air ducts or other air circulating passages. Brine or water cooled by such refrigerants may be sprayed into such air passages or may be circulated through coils located in such passages, but no such brine shall contain any flammable constituent.[4]

Refrigerants which are both non-flammable (or practically so and for the purpose of these regulations are so considered) and have been classified by Underwriters' Laboratories as less toxic than Group 4 include: Carbon Dioxide; Dichlorodifluoromethane (F-12); Dichloromonofluoromethane (F-21); Dichlorotetrafluoroethane (F-114); Monofluorotrichloromethane (F-11); Methylene Chloride (Dichloromethane).

272. Unless otherwise provided by these regulations mechanical refrigerating equipment shall be installed in accordance with the American Standard Safety Code for Mechanical Refrigeration.

273. Heating equipment shall be installed in a standard manner with due regard to proper clearance between hot surfaces and woodwork and other combustible materials.[5]

274. Where systems are confined to a single fire area and floor, which is subdivided by fire partitions, fire dampers shall be installed at fire partition walls and the blower arranged to shut down automatically when required by the inspection department having jurisdiction.

**280. Air Conditioning Systems in Dwellings.**

The installation of these systems in dwellings shall be governed by the following requirements only:

281. The temperature at the beginning of the main supply duct from a direct heat furnace shall be controlled by approved thermostatic devices so as not to exceed 200° F.

[4]Refrigerants which are flammable or which have been classified by Underwriters' Laboratories in toxicity classification Groups 1 to 4 include:

| | | |
|---|---|---|
| Ammonia | Ethane | Methyl Chloride |
| Butane | Ethyl Bromide | Methyl Formate |
| Dichlorethyl-ene | Ethyl Chloride | Propane |
| | Methyl Bromide | Sulphur Dioxide |

[5]The inspection department having jurisdiction should be consulted regarding standard requirements for installation of heating equipments.

282. Ducts shall be constructed entirely of non-combustible material equal in structural strength and durability to I.C. tin or galvanized iron; provided that pipes twelve inches or more in diameter shall not be made of material lighter than I.X. tin or No. 26 U. S. gauge galvanized iron.

283. Ducts for conveying conditioned air from heat supply unit to vertical or wall stacks shall have a clearance of at least one inch from combustible material.

284. No ducts from a direct heat furnace shall be placed in a floor, partition or enclosure of combustible construction unless it is at least six feet distant in a horizontal direction from such direct heat furnace.

285. Where running horizontally through concealed ceiling spaces and where extending through from story to story located inside combustible partitions or walls, ducts or interior surfaces of such partitions or wall shall be protected by ¼-inch asbestos or other approved insulating material. The integrity of fire stopping shall not be destroyed. The space between the duct and the fire stopping shall be filled solidly with brick, asbestos, mineral wool or other approved non-combustible material.

**290. Ventilation of Restaurant Type Cooking Equipment.**

291. Hoods over such equipment shall be constructed of non-combustible materials, with tight joints and have a clearance of at least 18 inches from all unprotected combustible material.

292. Ducts from hoods over such equipment shall be constructed of No. 18 U. S. gauge or heavier steel, with tight joints and separated at least 18 inches from all unprotected combustible material.

293. The ducts shall constitute an independent system in no manner connected with any other ventilating system.

# Poor Ductwork Hinders Winter Air Conditioning

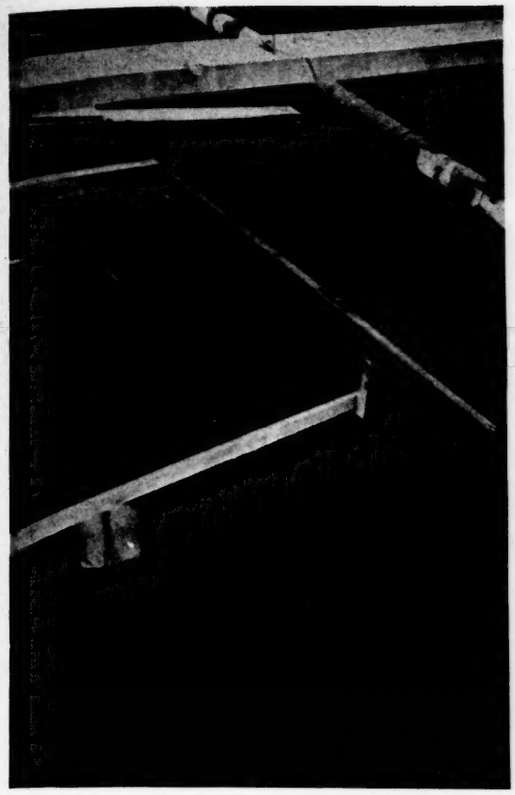
WHY the public is swinging away from winter air conditioning for residences is mainly because of poor ductwork. Many residential systems are poorly designed, and some are not designed at all. There are many cases of jerry construction because either the contractor did not know how or what to do, or because the customer wanted too much for his money. He did not want to pay an extra hundred or two for a first class job that would give him no headaches. Instead of having a heating engineer go over the house and figure out everything for him beforehand, he calls in a contractor and asks "how much." Maybe two or three contractors will figure on the job and the houseowner or builder takes the one who is lowest, regardless of his engineering knowledge or experience in winter air conditioning, and regardless of his financial responsibility.

The public mind is muddled on the subject of winter air conditioning for residences. There is a hesitation on the part of reliable architects and builders, because of so many unsatisfactory jobs. We can trace most of this dissatisfaction to chiseling. It may be the architect, who knows but little about air conditioning, to the builder who wants to save an extra $200 or $300 on the price of the completed house, or to the owner who forces too low a completed price. No matter who is responsible, a jerry job makes a dissatisfied customer and destroys confidence in all architects and builders.

Yet inside of five years winter air conditioning will be standard in new homes. Architects and builders will know more about the subject and heating and air conditioning contractors will turn down jobs that cannot be done right at the cut price.—*Abstract of an address by A. V. Purdue, before the Air Conditioning Bureau of Boston.*

# A College System of Service Tunnels

By WILL V. NORRIS†



*Construction of service tunnel through rock.*

THE University of Oregon, in cooperation with various relief agencies of the Federal Government, such as the SERA, FERA and WPA, has under construction an intensive program of building service tunnels on the campus of the University. The work started early in January, 1935, and has continued without any serious delays. The program provides for future construction under similar conditions. This type of work relief has the advantage in that it makes possible the employment of a large number of unskilled men, using only a small number of skilled workmen. The percentage of materials required is less than in usual building operations, still the usefulness and permanency of the work are of a high order. The method of financing has been for the Government to furnish the labor, except supervision and engineering, with the cost of materials and equipment being paid jointly by University and the Government. The complete plan calls for 6920 ft. of tunnel at an estimated cost of $400,000. The organization consists of an engineer, supervisor, bookkeeper, timekeeper, labor foreman, and between 40 and 125 men. Two shifts are used when the larger number of men is available.

The tunnels are so designed that they care for all campus services, except sewerage, that might be required in the various buildings. They also act as a drainage medium for excess flood waters that might run into the basements, and could not be handled by the regular sewer system. The services include (see Fig. 3) 30-lb. steam mains for heating; condensate lines; city water; irrigation water; 2300-volt, three-phase a.c.; 220-volt, three-phase a.c.; 110-220-volt lighting a.c.; 2300-volt series street lights; telephone; fire alarm signals; remote heat controls; compressed air for automatic controls; gas; class bells; clocks, and tunnel lighting. The steam lines are supported on trapeze hangers on the inside part of the tunnel loops, while the other services are supported upon steel channel on the opposite side. There is sufficient room for inspection and maintenance, also space for various meters, control valves, and switches. Provisions are made for 10 transformer vaults which are located along line of the tunnels. The heated air of the system is used in the basements of Library and McArthur Court, the buildings being located at the upper end of each main section. These outlets are about forty feet above the elevation at the Power Plant, causing the tunnels to act as flues.

The Heating Plant is located at the northeast corner of the campus and, fortunately, is at the lowest elevation of any building, which makes possible a gravity system of returns. Running from here in a southerly direction are two main tunnels, one terminating at the Library, and the other at McArthur Court. Between these two tunnels are connection tunnels and ducts, forming what we call our loop systems. That is, when completed any service can be maintained from either direction, making possible the repair of any small section, with little inconvenience. From the main central loop are several smaller ones (see Fig. 1), as well as many short branches running to single buildings. The thought back of the whole plan is to provide continuous service at all times, if possible, even with breakdowns in certain sections. At each cross connection are three valves, giving full control. Intermediate valves are also often installed. A study of the plan will show how this has been worked out. Units 1, A, 6, and 2 form a loop; Units 6, 3, C, B, and 4 another for steam; Units 4, B, I, 11, and 10 a third, while A, 4, 10, 12, 9, and 8 a fourth. Several others are possible without much additional work.

The method of excavation consists of open-cut, although under streets and several buildings the usual tunnel procedure is used. Naturally as much unskilled labor is used as possible, but not to the point of allowing the efficiency of the work to be lowered. At first, in rock, blasting was tried, but later we substituted air and jack-hammers, the rock being quite friable. After pouring the concrete, the trench is backfilled with material directly from excavation, thus reducing the handling of material twice. The depth of cut varies from 10 to 38 ft., and width at bottom from 7 to 9 ft. A lengthwise slope is run into the tunnel and trucks are

†Professor of Physics, University of Oregon, Corvallis, Oreg.

driven directly into the new work. In a few cases the old steam and water lines, sewers, and cables made it necessary to lift the material to surface by hand on stage platforms.

Standard dimensions are adopted as follows: inside tunnel, 6 ft. wide by 7 ft. high; wall, 8 in. wall and top. Only in special cases are these dimensions varied (see Fig. 3). This size allows ample room for all purposes intended. The mix used is one to six, using graded river gravel and standard portland cement, with the proper percentage of steel. Hanger inserts (see Fig. 2) for the steam lines are placed in the top and on the inside part of loops which are spaced at 12-ft. centers. On the opposite sidewall are placed three ¾-in. bolts for the wall channels, these being on 10-ft. centers. The material was well tamped, and in general the grade of concrete was very good, especially when one considers the inexperience of the labor used. Test on the concrete averages above 2000 lb. per sq. in. Standard wood forms are used, except on sidewall in rock, where no outside forms are needed. A 6-in. drain is placed under the floor, with gravel bleeders. On each side of bottom are two circular drains, made by using old 5-in. pipe.

It has been necessary to underpin several of the buildings and the following method was used: Small sections 4 to 8 ft. in length are excavated under the old foundations and these were then poured with concrete up to within 2 in. of the old work. After standing three days, this space of two inches is filled with a very dry sand-concrete mix which is thoroughly driven in with hammers. In 21 days the intermediate sections are excavated and treated likewise. In no case has there been the least settlement of a building wall, including our 125-ft. stack.

We are using a special design of hanger-insert (see Fig. 2). Our past experience has indicated that most tunnel hangers fail because of rusting at the point where the hanger contacts the concrete. The new design has the advantage in that the hanger rods can be easily replaced should they rust. The inserts are made of cast iron and being embedded into the concrete they should last for years. The diagram gives all the dimensions necessary for the production of the hangers, except that on the top, the two knobs are used to hold two ¾-in bolts about 3 in. long, after being drilled and tapped. The purpose of these bolts is to carry the weight until the concrete is fully cured, or in case a poor bond develops along the edge of the hanger insert.

A special design of trapeze hangers and wall anchors was also used. These have the advantage of being inexpensive, as any part can be easily replaced if necessary, because they are made from standard fittings. The anchors required a special pattern, but once obtained can be made quickly. They are simple and effective. Sufficient room is provided for flanges, as the center of the pipe is 12 in. from the wall for 10-in. pipe, 10 in. for 8-in. pipe. A list of material necessary for the construction of the trapeze hangers needed in 1000 ft. of tunnel (84 hangers) is listed in the accompanying table.

The specifications covering the steam mains call for copper bearing pipe, welded joints, except at valves and expansion joints which are flanged. Condensate is made to flow with the steam, which requires many rises. These are made with two 45° elbows, the lower one being trapped. Piston type expansion joints are used on all new work and condensate meters are used at each building. The working pressure is 30 lb., but all lines have been installed to handle 125 lb. if necessary. Branch steam lines are taken off in

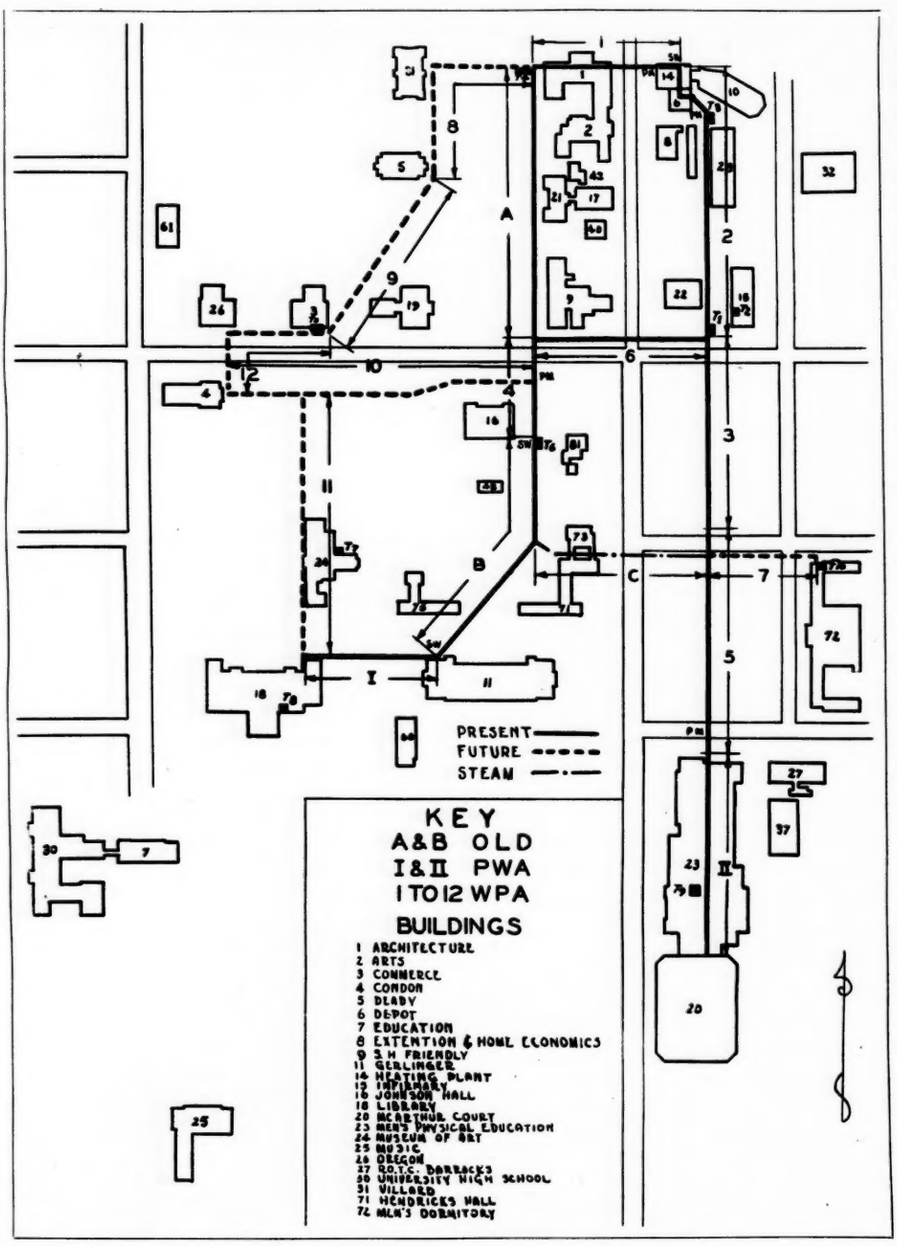


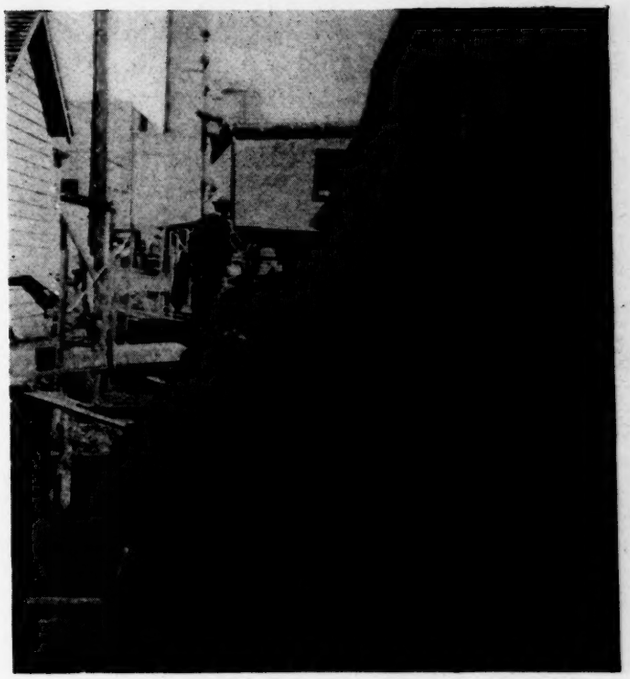

*Fig. 1. Plot plan of tunnel layout.*

| Quantity | Item |
|---|---|
| 675 ft. | ¾ in. Galvanized iron rod |
| 336 | ¾ in. Galvanized iron nuts |
| 168 | ¾ in. Galvanized iron washers, ¼ in. thick, 1⅝ in. diameter |
| 168 | 1¼ in. Galvanized malleable caps |
| 168 | ¾ in. Galvanized awning tips or eye end sockets for ½ in. bolts No. 5 |
| 168 | ½ in. x 1½ in. Galvanized iron bolts with nuts |
| 300 ft. | ⅛ in. x 1¾ in. Galvanized iron band |
| 147 ft. | 1¼ in. Galvanized iron pipe |
| 336 ft. | ¾ in. Galvanized iron pipe |

two ways. If a branch is on the same side as the main, a direct swing type of joint is made; but if the run is to the other side, the branch is carried overhead in a passageway provided in the tunnel roof. This allows freedom within the tunnel proper. In some cases this could not be done and the pipe was run directly across the tunnel. However, the locations in this job are such that they cause little trouble. All buildings are controlled from within the tunnel system. Provisions are being made for remote control at the Power Plant, in order to save the time of men in making daily trips through the tunnel.

On the side opposite the trapeze hangers are placed 4-in. steel channels, which are bolted to the wall by the three ¾-in. bolts embedded in concrete, with the flat side of the channel iron out. Pipes are placed on the channel either by regular pipe straps using bolts in tapped holes, or by a special type of hook, 2 to 6 in. long, which is inserted inside of channel. A strap between two such hooks can be drawn up tightly and will hold pipes up to 6 in., the largest now being installed.

A complete system of 10 underground transformer vaults is being installed to handle the primary 2300-volt service. These are all related to vault "$T_1$," where the power is received from the power company. Parkway cables (supported on the channels) of various sizes and capacities connect the different vaults. In the vaults are transformers for reducing the voltages to 110-220 volts for use as power and light. The secondary lines are run in lead covered wire in conduits to the building switchboards. Primary meters are installed on all 2300-volt lines. On the secondary lines a few meters are used in order to record the use of electric power by

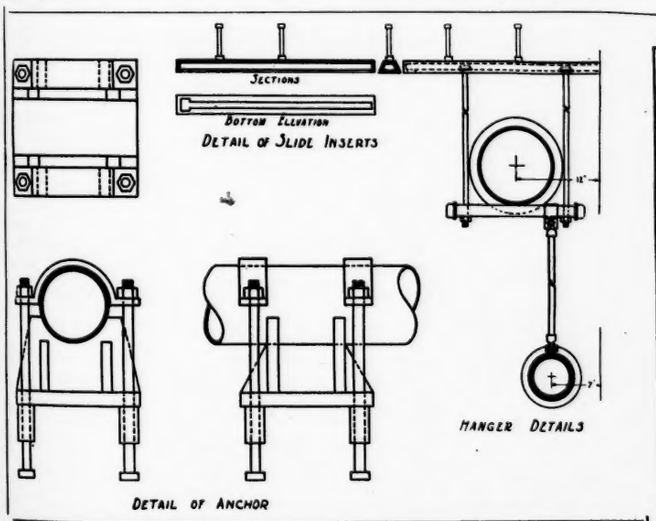


*Underpinning of the Press Building during service tunnel construction.*

various departments. The University buys its current, however, on one primary meter located in vault "$T_1$."

At each connecting tunnel is an angle corner in order that a full length of 10-in. pipe can be easily moved. This provision is important, as it requires fewer pipe manholes.

Several special pipe manholes, which are 20 in. wide and 12 ft. long are provided for at points "PM" on plot plan. These have concrete tops, with overlapping edges, sealed with a roofing gasket. Hooks in the tops allow for their removal with a small hoist when it is necessary to install additional large pipes. For small pipe and fittings, three standard 5-ft. sidewalk doors are installed at "SW." Manhole entrances are installed at regular intervals in order that men can get out easily in case of necessity. Entrances are also provided at the Heating Plant, Library, McArthur Court, and Architecture by means of stairs.



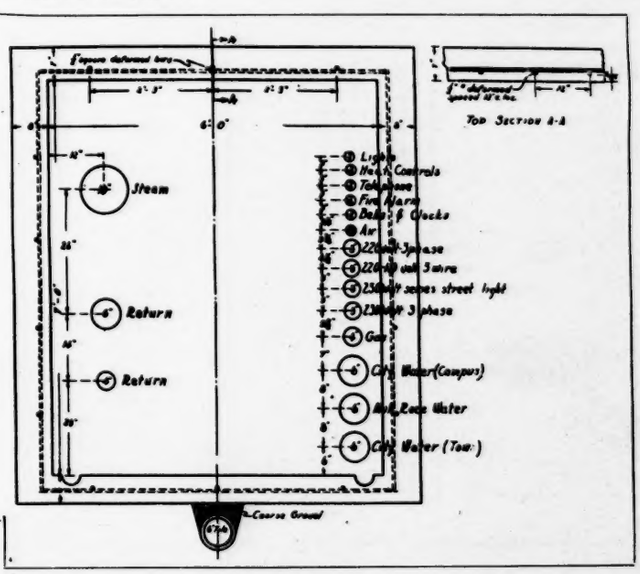




*Fig. 2. (Above). Anchor and hanger details. Fig. 3. (Right). Tunnel cross-sections showing pipe locations.*

# WINTER AIR CONDITIONING FOR HISTORIC VESSEL

ANOTHER move to help preserve the historic old frigate *Constitution* in her original aspect for the benefit of future generations has just been made at the Charlestown Navy Yard, Boston. "Old Ironsides," as she is popularly known in schoolbook histories, has been winter air conditioned. This modern improvement does not in any way detract from her appearance or attraction as an historic relic, but will serve to preserve her from danger of shrinking and checking as she lies at her dock alongside the modern steel warships now at the Yard. She is the oldest ship in the United States Navy now in commission, and the only wooden vessel ever air conditioned.

She now has a Carrier central conditioning system, simplified as much as possible, that was installed to protect her from the decay that is inevitable in ships which are not actively sailing the seas, unless measures are taken to prevent it, rather than for the comfort of the three officers and thirty men that form her crew, under command of Lieut. Eugene C. Burchitt. This naval detachment lives aboard the vessel, in order to protect her from fire and other damage during the night and to keep an eye on visitors and prevent any possible vandalism during the daytime.

Because of the vessel's exposed position, the interior of the ship is often bitterly cold in winter, and not only the crew but visitors would find it very uncomfortable on board without the steam heating system installed when she returned from her memorable triumphal tour of the American seaboard a few years ago. This is supplied by means of pipes from the central Yard heating plant, through pipes brought over the rail.

Unfortunately, the dry warm air tends to check the timbers and cause excessive shrinkage which, if not guarded against, would soon result in damage to the ship. Some evidence of this was found by the inspecting officers and it was determined to provide protection before it became serious.

A single central unit now provides an air change about every twenty minutes on two of the decks with a humidity of 30 to 35% with a dry bulb at 70F, based on any outside temperature to 20F. Unit heaters are also provided; these can be cut in should the outside temperature run below 20F, and especially if it drops below zero.

The installation includes a specially built humidifier with motor, fan, and steam connections. Air is drawn from near an outside bulkhead through a spray chamber, then over steam coils, after which the fan forces it through ducts, then through a series of grilles to the two decks that are conditioned. There are eight of these grilles on the gun deck and nine on the berth deck, placed about every twenty-five feet. Humidity control is automatic through control of spray water temperature.

The ducts are assembled with bolts and nuts, and at the joints butt against felt, closed with water glass. They are hung by means of brackets and screws from the overhead deck, and the entire system may be quickly dismantled and stowed out of the way during the summer, when it probably will not be required. White paint makes the whole job inconspicuous.

Ducts run along the gun deck over the 24-pounder guns on the port broadside, vertically through the main hatch and after-hatch to the berth deck, where they also run along the port side. Short branches extend part way across the deck and into the officers' quarters, taking care of distribution there, including the commodore's cabin, where the famous Treaty of Tripoli was signed in 1805.

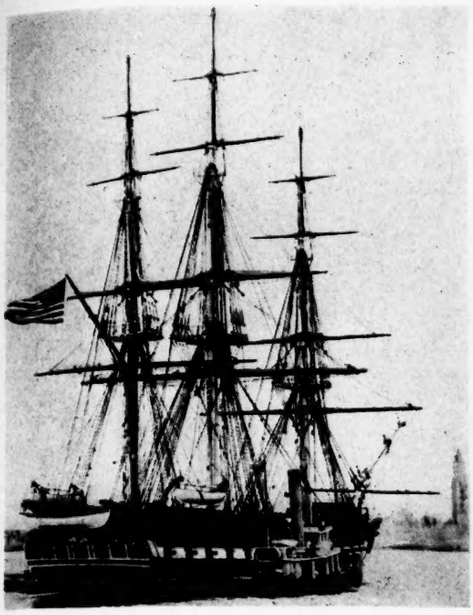
In her early days, when she was a fighting ship, heating on the *Constitution* was by means of sand-filled "hotpots," hung about the lower decks, in which were placed cannonballs, heated redhot in the galley and reheated when they cooled. Sufficient moisture to preserve the wood came from the daily washing down with buckets of pure sea water, drawn up over the side, and from the high waves which sometimes washed aboard during storms.

Since she has been docked, however, sea water could not be used for scrubbing the decks, because the harbor water is full of oil and other impurities which would soon damage the wood planking and cause an unpleasant condition. So the washing down now is preceded by the sprinkling of an inch or so of rock salt on the decks, after which fresh water is turned on, to run out through the scuppers. The salt dissolves, soaks down into the wood and re-crystallizes. This helps to preserve the wood and, with the air conditioning, will serve to keep the ship for many thousand more visitors.

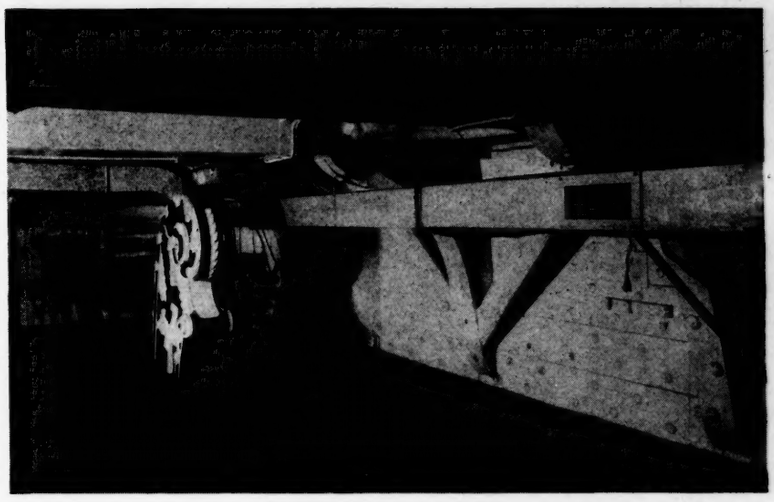
The distribution system begins about three feet away from the battle gong that called the crew to quarters for a duel with the enemy ship, and the boarding rattle that Capt. Isaac Hull used to summon the men with cutlasses and muskets for a boarding party when the two fighting ships closed. Ditty bags hang behind the air conditioning ducts on the berth deck and below the ducts are the big sea chests, still in use.

The *Constitution* was launched at Boston in 1797 and served in the War against Tripoli and the Barbary Coast pirates in 1804-5. In the War of 1812 she fought and destroyed the British frigate *Guerriere* and later the British ship *Java,* and captured the smaller British ships *Cyane* and *Levant*. She is of 204 ft. overall length, 44 ft. 8 in. beam, and 22 ft. 6 in. draft. She was originally armored with thick oak planking, which caused round shot to bounce off her sides from which she won the nickname of "Old Ironsides." She was restored for the fourth time in 1927, at a cost of $650,000, half of which was contributed by school children in pennies.

# AIR CONDITIONING "Old Ironsides"

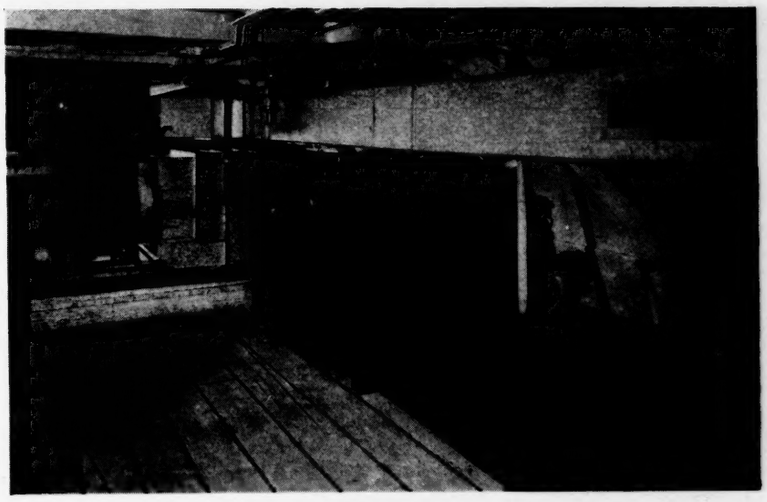


The United States frigate *Constitution* is shown above being towed by two tugs up Boston Harbor to her berth at the Charlestown Navy Yard. The famous old vessel, restored for the fourth time in 1927, has now been winter air conditioned to preserve her timbers from checking and shrinking which might result from lack of moisture in the air.



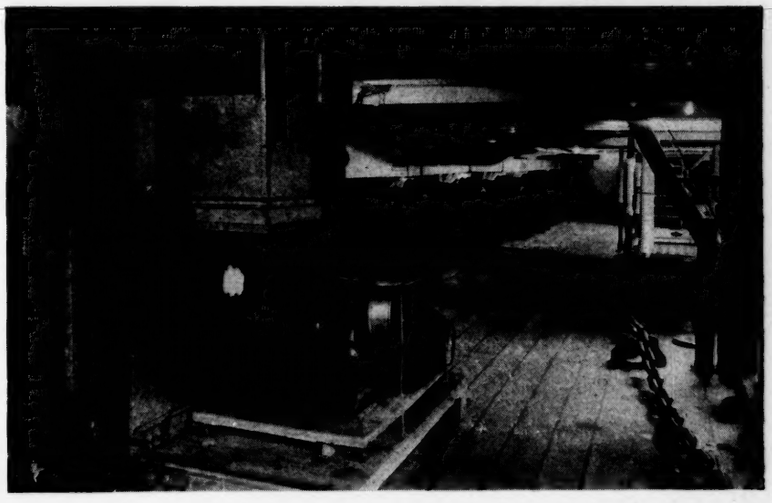
1

1—A section of duct on the berth deck—that next below the gun deck, and on which were the crew's quarters—with the old figurehead standing on a platform. Along the edge of the deck is shown the covered-up test holes which were drilled to determine the condition of the ribs and knees of the framework. In the background is shown a unit conditioner which can be moved about to protect any spot not reached by the distribution system carrying humidified air.



2

2—A close-up view of the air conditioning installation with a portion of the gun-deck duct, showing one of the grilles and a single gun. Just beyond the gun is the air washer. In the background is a continuation of the duct to the after-part of the gun deck.



3

3—The gun deck, showing the air conditioning installation, including fan, housing, main duct, motor and steam heating connections, with part of the broadside of 24-pounders on the main gun deck. The air conditioning installation is placed a little aft of midship on the port side.

# ENGINEERING NOTES

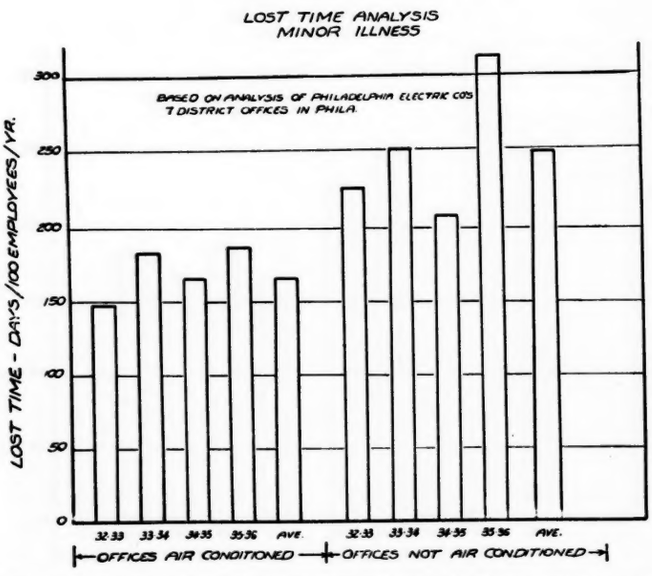
## • New Method Invented for Measuring Heat Conductivity

First prize of 7800 francs in the awards established by Jean-S. Bares for French inventors has been given to Pierre Vernotte, an aeronautical engineer, for his method of measuring the heat conductivity coefficients of different substances. In the method of testing metals invented by Mr. Vernotte, a cylinder of the metal undergoing the test, from 3 to 4 mm. in diameter and several cm. in length, is placed in a "calorific radiator." This small electric oven, which radiates a fixed heat in relation to the outer temperature, is perforated to receive the sample of metal. The metal bar is introduced in the oven, one end extending outside. The quantity of heat dissipated by the oven is increased by an amount which represents exactly the heat given off by the bar itself.

## • Four Year Survey Reveals 34% Reduction in Employe Illness

During the past four years, the Philadelphia Electric Company has operated two completely air conditioned district offices and five district offices without air conditioning in Philadelphia. An average of 39 inside employes worked in each of the air conditioned offices during this period and an average of 51 inside employes worked in each of the other five district offices. These studies brought out one interesting fact; i.e., that approximately 75% of the lost time was due to minor illness. The annual lost time for these two groups is shown in the chart, which reveals an average reduction in these losses due to minor illnesses for the entire period of 34% among employes working in air conditioned surroundings.

Using these proportions for the average office, it can be said that 5.25 days per employe are lost due to minor illness. Since the owning and operating costs of air conditioning will average about $0.15 per sq. ft. per year, assuming 75 sq. ft. of office space per employe, the cost per employe per year would be $11.25.




*Time lost for minor illnesses in offices which are air conditioned as compared with ones which are not.*

In other words, the reduction in lost time alone will obviously offset a high percentage of the annual owning and operating costs.

Another factor, far more difficult to gauge, to be gained through air conditioning working quarters, is that of improved efficiency. But the fact remains that many employers consider this factor to be of even greater financial importance. Certainly, healthier employes, free from the harassment of minor ills so often caused through uneven temperatures and germ laden air, can reasonably be expected to give better results. If such an increase of efficiency should be as small as one-quarter of 1%, this, with the saving in reduction of lost time, will offset the entire cost of air conditioning.—*Air Conditioning News*

## • Pampered Monkeys

The Curator of Mammals of the London Zoo stated in a recent interview that the London monkey house was second to none in the comforts afforded to the monkeys. "The monkey house, like all animal houses at the London Zoo, is fitted with central heating," he explained. "We have to be extremely careful of the health of the monkeys. They are even more susceptible to damp and cold than human beings. Just like humans they suffer from rheumatism and colds, and appreciate an even temperature. Their house is therefore heated with hot water pipes and radiators very much the same way as a room in a modern house. The monkeys have benefited considerably from the properly warmed cages and good ventilation."—*The Heating and Ventilating Engineer, London.*

## • Compiling Weather Reports

How do we get that report of "Fair and Warmer," or of a cold wave, or a hurricane coming?

Few people know of the special Western Union telegraph set-up which makes possible the daily weather report protecting the nation's life and property, fruits and crops, ships and airplanes, and public and private affairs of all kinds.

Daily at 8 a.m. and 8 p.m., E.S.T., the telegraph company swiftly transmits weather reports from some 250 points in the United States and Canada to its main operating rooms at New York or Chicago.

These reports are in code, such as: "Pittsburgh Rinal Herny Deceit Tebars," which gives the Pittsburgh barometer and thermometer readings at 8 a.m.; and says the sky was cloudy, wind from southwest, minimum temperature was 60F during the night with 24-mile wind velocity; .04 in. of rain in the last 24 hr., and the Ohio River gauge was 21.3 ft. and the water level falling.

Speed and accuracy are essential because rapid changes make delayed reports worthless except as a matter of record. Western Union does not waste a second when the 250 local reports arrive at New York and Chicago. As each report arrives, it is attached to a sheaf of blanks ready-addressed to as many of the 140 Weather Bureau stations over the nation as take the report of the city originating it. Most of the 140 stations have a standing order for the reports from a wide distribution of places, and the reports from most of the 250 points are taken by the U. S. Weather Bu-

reau stations located at Washington, D. C., Chicago, New Orleans, Denver, and San Francisco, at which points the weather is forecast officially for their five sections of the nation. In all, approximately 11,000 weather reports are handled by Western Union daily in the space of a half hour in the morning and evening; so rapid is the service and so thorough is the set-up made in advance.

When a report arrives at New York or Chicago, it is sent by the receiving operator by fast conveyor belt to the "D&A." or Duplicating and Addressing Department, on an operating floor. There the report is handed to a clerk who takes the sheaf of pre-addressed blanks from a pigeon-hole bearing the name of the reporting city. He hands the report and the blanks to a typist who immediately cuts a stencil and hands it to a comparison clerk who verifies the accuracy of the stencil. He, in turn, hands it to one of the mimeograph operators. As soon as the mimeograph machine runs off all copies of the report, they are placed on conveyor belts and pass swiftly to sending operators, who transmit them to numerous destinations. The individual reports are used by the various local weather stations in making up their daily weather maps which are distributed locally to subscribers to the map service, and for display in post offices and other nearby places.

When the forecaster at Washington, Chicago, New Orleans, Denver, or San Francisco receives his reports and makes his forecast, he hands it immediately to an operator who transmits it to the local Western Union office. There the forecast is duplicated on pre-addressed blanks and transmitted immediately to numerous points for use in the maps.—*Dots and Dashes*

## • How to Install Dust Control Exhaust Piping

Hoods should be constructed according to needs of the particular application but in all cases the dust creating process should be enclosed as fully as possible without unduly interfering with operations. Hoods must be designed to take advantage of the force and direction of the dust particles leaving the operation creating the hazard. It must be remembered that air velocities in front of an exhaust hood drop approximately inversely with the square of the distance from the opening. The most efficient dust collector is but half of a dust control installation, and improper hood designs can render the entire installation useless from an efficiency standpoint.

Hoods should be free from sharp edges and reinforced if necessary. Hinged sections are necessary for quick access for replacements, as in grinding wheel installations.

Piping should be run in a direct line to the dust control system if possible, but should not interfere with cranes, trucks, etc., and should be accessible for inspection and cleaning or repairs. Where abrasive wear is encountered, it is eventually cheaper to install heavy pipe with flanged bolted joints.

Changes in pipe sizes should be made with a gradual taper of 5 in. lengths to every inch in diameter, preferably keeping the bottom of the pipe straight its entire length. Branch pipes should enter the main near the large end of the taper preferably on the side or on the top of the pipe. The branch should enter at an angle of 30° to 45° with the axis of the main. Except in special cases, the area of the main pipe at any point should equal the sum of the area of all branch pipes behind the point. Pipes should be amply supported and cleanouts with tight covers should be installed at intervals on horizontal runs, and at bends, dead ends, etc., where dust is most apt to settle.

Pipes should be kept free of obstructions, such as screens, etc., and branches should not project into the main. Joints should lap in direction of flow.

Elbows should be well formed, seven sections preferable. The centerline radius should be twice the pipe diameter where possible, or a throat radius of 1½ diameter. Elbows should be constructed of material two gages heavier than corresponding sizes of straight pipe.

Blast gates, for balancing the system, should be located near the junction with the main line if accessible. Means should be provided for fastening the gate slide in the desired position.

It is recommended that the following gages be used: 4 in. to 12 in. dia.—#20 gage; 12 in. to 32 in. dia.—#18 gage; 32 in. dia or over—#16 gage.

Joints should be riveted and soldered or double lock seam.—*C. A. Snyder, The American Foundry Equipment Co., Mishawaka, Ind.*

## • Standard Drinking Water Requirements

The Commercial Refrigeration Section of the National Electrical Manufacturers Association has recently adopted standard specifications for drinking water requirements for various types of service. Heretofore, there has been considerable variation in the estimates made by different water cooler manufacturers as to the capacity of unit required for a given installation, with resulting confusion when competitive bids have been compared. The specifications follow:

**DRINKING WATER REQUIREMENTS FOR VARIOUS TYPES OF SERVICE**

**The standard delivered water temperature and amount of water per hour for different classes of service shall be as given in the following table:**

| Type of Service | Delivered Water Temp., F. | Gal. Per Person Per Hr. | Waste and Consumption Per Person Per Hr., Oz. | Consumption Only Per Person Per Hr., Oz. | People Served Per Gal. |
|---|---|---|---|---|---|
| Office (cup) | 45-50 | .033 | 4.2 | 4.2 | 30 |
| " (bubbler) | 45-50 | .083 | 10.5 | 4.2 | 12 |
| Light mfg. | 45-50 | .143 | 18.3 | 7.32 | 7 |
| Heavy " | 50-55 | .20 | 25.6 | 10.24 | 5 |
| Hot heavy mfg. | 55-60 | .25 | 32.0 | 12.8 | 4 |
| Restaurant | 40-45 | .1 gal. per person | | | |
| Cafeteria | 40-45 | .083 gal. per person | | | |
| Theater (movie) | 45-50 | 1.0 gal. per 100 seats | | | |
| Theater (legitimate) | 45-50 | 1.0 gal. per 100 seats continuous capacity. Each fountain shall have storage capacity to provide 5 gal. in 10 min. | | | |
| Schools | 45-50 | Same as office. | | | |
| *Hospitals* | | | | | |
| A.—Per bed | 45-50 | .083 gal. | | | |
| B.—Per attendant | 45-50 | .083 gal. | | | |
| Hotels | 45-50 | .08 gal. per hr. per room | | | |
| Public fountains—(amusement parks, fairs, etc.) | 45-50 | 20 to 35 gal. per hr. | | | |
| Dept. stores, hotel and office building lobbies | 45-50 | 4 to 5 gal. per hr. per fountain. | | | |

# WHAT READERS SAY . . .

## Friction Factor

I have before me the formula for determining the pressure drop in water flowing through pipes. Will you please give me the values for $F$ in this formula.

Philadelphia. S. F.

$$DP = \frac{FLV^2R}{2GD} \quad \text{or} \quad DH = \frac{FLV^2}{2GD}$$

when

$DP$ = Pressure drop in lbs. per sq. ft.; $DH$ = Loss of head in ft. of water; $L$ = Length of pipe in feet; $G$ = 32.16 ft. per sec. per sec.; $D$ = Diameter of pipe in ft.; $V$ = Velocity in ft. per sec.; $R$ = Fluid density in lb. per cu. ft., and $F$ = Friction factor.

The accompanying table gives values of the friction factor $F$ for use in the formula commonly used for finding the capacity of pressure drop in pipes through which water is flowing. This material is abstracted from Marks Mechanical Engineers Handbook. So far as we know this is considered authentic and practically the same material is repeated in all engineering handbooks. The value of $F$ varies with the diameter of the pipe and with the velocity of flow.

VALUES OF FRICTION FACTOR

| Diameter | For Fairly Smooth Pipes Values of $V$ in ft. per sec. | | |
|---|---|---|---|
| | 1 | 5 | 20 |
| ½ in. | 0.054 | 0.043 | 0.036 |
| 1 in. | 0.046 | 0.036 | 0.030 |
| 4 in. | 0.032 | 0.026 | 0.021 |
| 12 in. | 0.024 | 0.020 | 0.016 |
| 24 in. | 0.021 | 0.016 | 0.014 |
| 36 in. | 0.019 | 0.015 | 0.012 |
| 5 ft. | 0.016 | 0.013 | 0.011 |
| 10 ft. | 0.014 | 0.011 | 0.009 |
| 20 ft. | 0.012 | 0.009 | 0.008 |
| | For Rough Pipes Values of $V$ in ft. per sec. | | |
| | 1 | 5 | 20 |
| ½ in. | 0.071 | 0.066 | 0.061 |
| 1 in. | 0.060 | 0.055 | 0.052 |
| 4 in. | 0.042 | 0.039 | 0.036 |
| 12 in. | 0.032 | 0.030 | 0.028 |
| 24 in. | 0.027 | 0.025 | 0.023 |
| 36 in. | 0.024 | 0.022 | 0.021 |
| 5 ft. | 0.022 | 0.020 | 0.018 |
| 10 ft. | 0.018 | 0.017 | 0.016 |
| 20 ft. | 0.015 | 0.014 | 0.013 |

Abstracted from Marks Handbook.

## Fair Payment

Not long ago I brought suit against a concern in New Jersey, and while waiting for my case to be called I overheard a lively dispute between a piping contractor and a gentleman who refused to pay the price charged. The piping contractor was the plaintiff and the gentleman who refused to pay was the defendant. The defendant declared in a loud voice that the plaintiff's charge was "outrageous," that he was being "soaked," and so on.

The plaintiff, who plead his own case, admitted that he charged more than he would have paid his own men, had his employes done the work. He did the work himself. He is in the "heating and piping business" with a work shop and office and therefore has an overhead which his employes do not have. During normal times this piping contractor employs workers, but on account of the depression he was forced to lay them all off and personally do certain jobs as they came along. He also declared that he was a "master plumber"—that his work was of a higher grade than that performed by the average worker. "Therefore," he summed up, "I believe I am entitled to a higher rate of pay than would be received by an ordinary employe of mine not working under my supervision."

The judge agreed with the piping contractor and despite the further protests of the defendant and shouts that he was being "robbed" the judge calmly said,

"You will pay the bill in full, with costs."

New York, N. Y. W. F. S.

## Madison Square Garden

We refer to the article on the Madison Square Garden appearing in the October, 1936 issue of your publication, and take the liberty to call to your attention an error which is rather important as it may lead to the wrong conclusions.

In the last sentence of the chapter on air inlets, you state "and utilizing an entrance velocity of approximately 1,000 f.p.m." In fact, the entrance velocity is more than 1,200 f.p.m. which to engineers is an important factor. We wonder whether you would be good enough to correct this error somewhere in your next issue; we would greatly appreciate this. . . .

Anemostat Corp. of America, New York, N. Y. — Aug. Rust-Oppenheim, President

## Attic Fans

In the last few years we have been very active in the promotion of attic fans for comfort cooling in residences. We have found a fine market for this equipment in the southern states, and just recently I have been devoting all of my time to the promotion and sale of this equipment.

In the September, 1936 issue of HEATING & VENTILATING, on page 39, I read an interesting comment on cooling a home with night air, or attic ventilation. This was a very fine article. I think everything stated in this article is absolutely true and represents conditions as they are in the northern states. We have, however, encountered a little different situation in the southern states. By this I refer to Missouri, Kansas, Oklahoma, Texas, Louisiana, etc.

In the article mentioned above there was a statement as follows: "Curves indicate that effective cooling with outdoor air at night cannot be accomplished with less than ten air changes per hour and above thirty changes per hour the gain resulting from increasing the amount of air is very small."

About three years ago we started selling this equipment and selected our fans on the basis of thirty air changes per hour, believing from this test record that we were entirely safe. A few jobs went in and were reasonably satisfactory. However, we have found that by sizing these fans on sixty changes of air per hour instead of thirty, the increased results are well worth while in these southern climates.

I don't believe we get any appreciably lower temperature inside the house on a sixty air change as compared to thirty, but we do get a much more rapid air motion which accounts for the increased benefits and also for such wonderful enthusiasm on the part of the customer who has purchased such an installation based on sixty air changes per hour. Not only in one instance, but in many cases we have found that after making one or two installations in a small town our dealer will install from eight to ten more fans the very first year. This is due to the fact that the owners like the installation so well they will go out and

spread the news to all of their neighbors. It is just like a chain letter except that it does not fade out so quickly.

We are not able to get such enthusiasm out of our customers when these fans are sized on thirty air changes per hour, and for that reason we believe we are correct in saying that for the southern states a sixty air change per hour basis is the correct one. You understand that our temperatures here in these states are from 108F to 117F in the day time and will stay up to 92F to 95F until 12 or 1 o'clock in the morning. Around 4 a.m. the temperature finally drops to about 85F to 87F. If a man has an attic fan based on sixty air changes per hour in his home, even though the temperature is 95F at midnight he can go to bed in comfort and go to sleep immediately. Most of our customers tell us that along about 4 o'clock in the morning they invariably reach for cover.

I inspected one installation in Independence, Kan., at 3 o'clock in the afternoon. The house was completely closed and the lady had gone to the trouble of even pulling down the window shades. She was testing the equipment and had a thermometer inside and another thermometer outside. The outside thermometer registered 108F and the inside thermometer registered 88F. Many of our customers have written us saying that they get such a difference in temperature with this equipment but I had always been skeptical of it until I saw it with my own eyes. I did not believe that the temperature lag would be so great. The above house was a wood frame cottage, with no insulation, but the attic did have flooring.

I thought you might like to have this letter because I believe some of the data which have been published on attic ventilation does not bring out the exact situation which occurs in the southern states. We were not at all questioning the correctness of the data which are published because we feel they are entirely correct, and have installations to prove them in the north. We believe, however, that the progress of this type of cooling for homes could be helped considerably by organizations like your own who could in some very effective way bring out the difference between a northern installation and a southern installation, primarily due to the high temperatures which are prevalent in the south both during the day and night.

Please do not think that we are basing our remarks on a few installations. As far as I can tell, at the end of this season we will have about 5000 installations in operation in the southern states, so you can see we have enough installations to prove to us that sixty air changes per hour are really worth while in the south.

AMERICAN BLOWER CORP. H. S. SHAFER
Kansas City, Mo.

## Silica Fumes

Would you tell us what requirements the State of New York asks for when installing an exhaust system of ventilation for removing silica fumes in factory buildings? If you have not this information, can you refer us to anyone?
Montreal, Que. F. A. P.

We do not know the requirements for installing an exhaust system of ventilation for removing silica fumes in factory buildings in New York at the present time. The principal reason for this is that the Legislature just closed passed an Act known as Chapter 887 of the Laws of New York. We have only recently succeeded in getting a copy of the Act. In going over it we notice that it authorizes the Industrial Commissioner and the Industrial Board "to add to the Industrial Code, as provided in sections 28 and 29 of the labor law, effective rules and regulations governing the installation, maintenance, and effective operation in all industries and operations wherein silica dust or other harmful dust hazard is present, of approved devices designed to eliminate such harmful dusts and to promulgate such other regulations as will effectively control the incidence of silicosis and similar diseases."

This new code was approved on June 6 last. So far as we can determine the rules and regulations mentioned have not yet been made public by the Industrial Commissioner. Just how that leaves the situation standing at present we do not know. Our suggestion, therefore, is that you write to Elmer F. Andrews, Industrial Commissioner, State Office Bldg., Albany, N. Y., and repeat your question and see if you cannot get a specific answer from him.

## Hospital Air Conditioning

Can you please give me any information on special requirements of air conditioning apparatus in hospitals?
Toronto, Can. L. S.

Air conditioning is commonly considered in two places in the hospital. One is in the operating rooms and another is in the individual rooms or wards. So far as we can determine there is a very sharp difference of opinion regarding just what should be done in connection with the air conditioning in operating rooms. Some physicians seem to feel that the conditions in an operating room are such that the temperature should be kept at not less than 85F with a relative humidity of 60% or higher. Others give figures which are considerably different from these but all seem to agree that the temperature at least must be rather high.

Another point in connection with these rooms is that there is usually ether or other inflammable gases present and that consequently any motors used must be explosion-proof. Such motors are naturally high priced and air conditioning equipment installed inside operating rooms is, therefore, very often too expensive to consider. The result is that a duct system is usually imperative. In patients' rooms the usual comfort conditions of 80F and 50% relative humidity in summer together with 70F and 40-60% relative humidity in winter are considered suitable.

## Radiator Paint

In a recent article in a newspaper, the following statement in regard to painting radiators was made:

"If more radiation was required of a radiator, and if the radiator was painted in a light shade of oil paint over the original bronze, the result would be 17% more heat. Or, if the heat from same was too great, the radiator painted in bronze would cut down this trouble."

As we have always believed heretofore that the opposite was so, we would appreciate any information you might have on the subject.
Philadelphia, Pa. W. G.

The most recent work in connection with the effect of paint on the heat output of radiator was done at the University of Michigan some seven or eight years ago. Both oil paints and flake metal paints were used in the tests. The results in round figures follow:

| TYPE OF SURFACE | HEAT OUTPUT |
|---|---|
| 1.—Bars unpainted radiator | 100% |
| 2.—Covered with various coats but top coat of aluminum bronze (silver) | 94% |
| 3.—Covered with various coats but top coat of aluminum bronze (gold color) | 93% |
| 4.—Covered with various coats but top coat of pigment paint (flat tone cream) | 104% |
| 5.—Covered with various coats but top coat of lacquer (brown) | 105% |
| 6.—Covered with various coats but top coat of enamel (white gloss) | 102% |

You will note that the flaked metal paints (the so-called bronzes) showed a reduction of heat output under the output obtained with a bare unpainted radiator, while the light colored pigment paints all showed an increase. In other words, bronzes cut down the heat output; light colored pigment paints increase it.

I believe the quotation which you give in your letter is therefore essentially correct in principle, although there may be some question as to whether there will be an increase of 17% due to painting a bronzed radiator.

# ABSTRACTS of Current Papers, Books and Pamphlets

## Heat Transmission Through Windows

In estimating the heat requirements of a building, proper account must be taken of the flow of heat through windows. In view of the dearth of information on this subject it was decided to make, during the winter months, a direct measurement of the thermal conductance of a window in the Experimental House at the Building Research Station. This particular window was situated in the moderately exposed north wall of a first-floor room of approximately 1,500 cu. ft. which was heated to a comfortable temperature by electric convectors situated near the opposite wall. The window has three lights and the lower portion of the middle light consists of a single pane of 21 oz. window glass measuring 18 in. by 29 in. The apparatus for recording the flow of heat was situated near the centre of this pane level with a pair of thermocouples arranged to record the difference in temperature between the inside and outside air 7 in. on either side of the glass.

The apparatus used for recording the flow of heat was comprised of two instruments, one of which recorded the flow of heat by convection and the other that by radiation. The convection instrument was essentially a system of thermojunctions arranged to record the difference in temperature between the layer of air in contact with the glass and the layer 0.5 cm. from the glass. In the original development of the instrument it was shown that this temperature difference was very nearly proportional to the heat flow by natural convection over the range required. The two instruments were connected in a suitable electrical circuit and the resulting e.m.f. was recorded. The calibration of the apparatus was effected by comparison with standard apparatus for recording the flow of heat.

It is well known that glass is transparent to radiation from the sun, but it is not generally realised that such radiation is reflected by clouds and buildings and that considerable amounts enter the windows in a north wall. The intensity of the solar radiation passing through the experimental window from this cause was sufficient to reduce the air-to-air thermal conductance considerably and, in fact, to cause it to become negative during the day period as early in the year as April. To avoid misleading results from this cause the only figures considered below are those for the period from sunset to sunrise.

In measurements on masonry walls conductance figures obtained over short periods of time may be misleading, but the thermal capacity of a glass window is so small that significant figures can be obtained for periods as short as one hour and accordingly the heat flow and air-to-air temperature differences for hourly periods were determined from the records.

The most valuable figures for the thermal conductance of building materials are those for the larger heat flows occurring in practice and in the present work attention was confined to those nights when the mean heat flow through the window was 25 B.t.u. per sq. ft. per hr. or more.

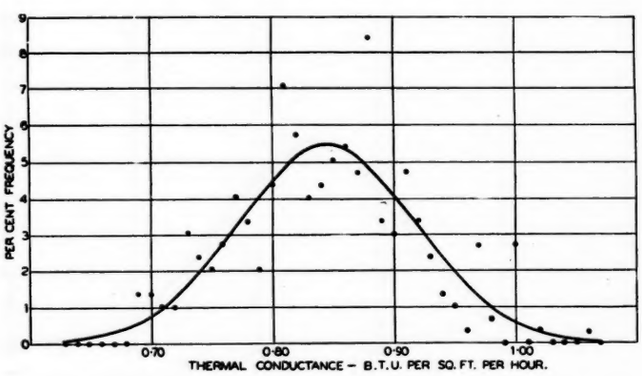



*Fig. 1. Normal frequency curve of thermal conductance of a glass window.*

The values obtained for the thermal conductance, for 296 hourly periods considered, lie substantially between the limits of 0.68 and 1.02. By plotting the observations on permille paper it was seen that the distribution is substantially normal: a normal frequency curve has therefore been fitted to the observed points and is shown in Fig. 1. In general, high values are observed on clear nights when there is considerable radiation from the outer surface of the glass to the night sky: it is interesting to note from some of the records that a sudden drop in thermal conductance occurs when a bank of cloud moves over the sky. The records show also that when a room is warming up, the thermal conductance of the window tends to be lower than when it is cooling down owing to the influence of the radiation from the walls to the inside surface of the glass. The effect of wind is to increase the conductance slightly but its effect is not nearly as severe as that of the clarity of the night sky.

Although the mean value of the thermal conductance was found to be 0.85 B.t.u. per sq. ft. per hr., on two occasions during the tests the conductance was greater than 0.9 for more than 12 consecutive hours, and mean value for 14 hr. on one night being 0.97. The present experiments, in fact, confirm that the round figure 1.0 B.t.u. per sq. ft. per hr., which is generally accepted for glass, is quite appropriate for use in calculating the maximum heat demand of a building.

[*"The Thermal Conductance of a Window," by W. G. Marley. Published in the "Journal of the Institution of Heating and Ventilating Engineers," London, November, 1936: pages 369-373.*]

## Simplified Cost Accounting for Contractors

For a number of years, the National Association of Master Plumbers has been publishing a simplified cost accounting system for heating and plumbing contractors. The purpose of this system is to give the contractor intelligent information on the condition of his business at all times. That the system is a practical one is shown by the fact that it is now in regular use by over 8000 plumbing and heating contractors.

The system is based on the double entry method of bookkeeping whereby two entries are made for each transaction and in general, everything that is received is debited and everything that goes out is credited.

When a job is assigned to a workman, a job record sheet is filled out, and a copy of it is given to the journeyman. The material and labor employed are noted on the copy by the workman while he is on the job and on completion turned into the office when the items are transferred to the original sheet and priced. Thus, this sheet contains a complete record of each individual job. These records of individual jobs are in turn transferred to a sales and cost record book in which is noted a complete history of each job. By referring to this book, the contractor can easily determine at any time the data on any particular job.

A cash journal and purchase register contains a double page form for the recording of receipts and disbursements. The left sheet provides for the expenses which go to make up the overhead. Also included on this sheet is space for listing the accounts chargeable to individual jobs and contractors. The right sheet in this book is used for recording receipts and disbursements.

A ledger made up of three sections is also provided. The first section is the general ledger, the second the customers' accounts, and the third accounts payable. The general ledger is for the assets, what is owned, the liabilities, what is owed, the job accounts, and overhead accounts. The customers' ledger section contains the accounts of those who owe money to the business while the accounts of those to whom the business owes money are carried in the accounts payable section.

Monthly trial balances to prove that the books are in balance are made on sheets for that purpose. From these accounts it is easy to prepare a monthly statement of the condition of the business. Complete directions with proper indexes are included with this system and a detailed instruction manual explaining all operations is also included.

[*"Cost Accounting System," Set No. 20 for medium or small volume business, $22.50; Set No. 200 for large volume business, $30; various items also sold separately. Systems are available through the National Association of Master Plumbers of the United States, Inc., Edmonds Building, 917-15th St., NW., Washington, D. C.*]

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## Arc Welding Handbook

The Procedure Handbook of Arc Welding Design and Practice appears in greatly enlarged form. The handbook has been reissued to include all new data essential for the most efficient use of arc welding in all its varied applications.

New data presented in the Procedure Handbook include information on the following subjects: characteristics of the welding generator; selection of type of joint; insurance of fusion welded vessels; welding codes; arc cutting; polarity of welding current; horizontal welds; sheet metal welding; effect of electrode size on welding cost; methods of testing weld metals; 4-6 chrome steel; monel metal; principles of surfacing by welding; welded design begins with standard shapes and plates; plate girders.

In addition to containing the above new data, the handbook has been thoroughly revised in all its departments in light of present-day arc welding practice.

The eight sections of the book cover the following subjects: welding methods and equipment; technique of welding; procedure, speeds, and costs for welding mild steel; structure and properties of weld metal; weldability of metals; designing for arc welded steel construction of machinery; designing for arc welded structures; and typical applications of arc welding in manufacturing, construction, and maintenance.

[*"The Procedure Handbook of Arc Welding Design and Practice," published by the Lincoln Electric Co., Cleveland, Ohio. Semi-flexible binding; 5¾ in. x 9 in.; 819 pages; price, $1.50.*]

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## Smoke and Air Pollution Regulation

In order to satisfy a demand for information on the subject of smoke prevention, the Smoke Prevention Association has prepared this manual of ordinances dealing with the various phases of smoke abatement work. The purpose of this book is to furnish information on the elimination of smoke to municipalities seeking establishment of anti-smoke ordinances, to architects and engineers interested in designing smokeless plants and buildings, and other persons such as contractors, chimney builders, and railroad and similar interests.

A large amount of data of interest to these parties is included in this publication. For instance, there is a copy of the Ringelman chart for grading density of smoke and also a table of headroom requirements for smokeless fittings of boilers.

Excerpts from papers presented and read to the conventions of the Smoke Prevention Association occupy a considerable portion of this manual. Some of the subjects discussed by these papers are smoke abatement problems, stoker requirements for smoke elimination, elimination of fly ash nuisance, the effect of smoke on health, principles in boiler design essential to smoke elimination. Following this section is a reprint of the model smoke abatement ordinance which was adopted by the Smoke Prevention Association. Other data in this book include firebox boiler operators' firing instructions, a summary of the answers to the questionnaire on smoke prevention which was made to obtain information on the ordinance regulation in effect in a number of cities.

[*"Manual of Smoke and Boiler Ordinances and Requirements." Published by the Smoke Prevention Association, City Hall Square Building, Chicago, Ill. Heavy paper cover; 6 x 9 in.; 80 pages including advertising.*]

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## Heat Losses From the Human Body

An analysis of the modes of losing heat from the body surface is important in understanding the mechanism for control of body temperature and the production of fever. Experiments carried on for the past twenty years by the Russell Sage Institute of Pathology with its calorimeter have eliminated much uncertainty as to the relation of the heat produced in the body to that eliminated from its surface and have carried the analysis of heat losses to the stage where it is known that under the standard experimental conditions about 24% of the heat lost is by means of vaporization of moisture. The development of an accurate instrument for the measurement of radiation permits us to estimate the amounts of heat lost through all channels. The proportions of heat lost by radiation, conduction and convection and vaporization are found to depend upon many factors. The physical factors include temperature of the air, of the walls of the chamber, humidity, air velocity, clothing and surface area exposed. Physiological factors include total heat production, vasomotor control and state of health. Measurements on a group of lightly clothed subjects while lying quietly in the calorimeter for periods of three hours show heat loss distributions as follows: Radiation, 60%; vaporization, 25%; convection, 15%. These proportions hold fairly well for clothed or unclothed subjects if the environmental temperature be kept between 77F (25C) and 81F (27C). Out of this range the effect of clothing is quite marked. Without clothes shivering usually occurs after several hours exposure to an environmental temperature below 75F and visible sweating at temperature above 82F. The quantitative study of convection has explained several paradoxes and has thrown light on Rubner's law of surface area.

[*"Heat Losses from the Human Body," by Eugene F. DuBois and James D. Hardy. Paper read before the National Academy of Science and published in Science, May 3, 1934, page 417. Paper abstracted in bulletin of the American Meteorological Society.*]

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## Thawing Frozen Water Pipes

A non-technical book designed for the average man and covering actual cases of pipe thawing. Includes information on the nature of the job, time required, length of pipe to be opened, size and kind of pipe, and costs. The methods used are explained by drawings and diagrams and various hookups for thawing pipes are presented.

[*"Thawing Frozen Water Pipes," published by Hobart Brothers, Hobart Square, Troy, Ohio. Paper cover; 6 x 7½ in.; free on request on business stationery.*]

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INDUSTRIAL GAS AIR CONDITIONING. A summary of the progress made in applying summer gas air conditioning to industrial plants. [*"A Recapitulation of the Progress Made in Applying Summer Gas Air Conditioning to Industrial Plants," by Charles W. Swenson. Published by the Industrial Gas Section, American Gas Association, 420 Lexington Ave., New York. Paper cover; 6 x 9 in.; 6 pages.*]

# Chicago Revises Its Comfort Air Conditioning Standards

IN the December, 1935 issue of HEATING & VENTILATING an article was published telling of the adoption in Chicago of air conditioning standards, sponsored and approved by various engineering and manufacturing organizations in that city. The standards were published in full in that issue.

These standards have now been revised and, in addition, a supplement to them has been issued. Space does not permit us to publish the revision or the supplement in full but a summary of these changes and additions follows:

The scope of the standards has been more definitely set forth in the new edition. The paragraph relating to this reads: "These standards are intended to set forth minimum application design requirements for comfort air conditioning and are not to be construed as limiting good practice nor preventing progress in the art. These standards are intended to be applied only to systems provided with mechanical circulation of the air and are not to be construed as applicable to air conditioning for private residences."

The paragraphs on minimum design temperatures and humidities for cooling now read as follows: "(a) Outside 95F d.b. and 75F w.b.; inside, 80F and 50% r.h. or equal effective temperature as determined from the summer comfort chart in ASHVE Guide in relative humidities between 35% and 65%. (b) Outside 80F d.b. and 75F w.b.; inside, 78F and 52% r.h. or equal effective temperature as determined from the summer comfort chart in ASHVE Guide in relative humidities between 35% and 65%."

In each of these foregoing two paragraphs, the phrase ". . . in relative humidities between 35 and 65%" is an addition.

Another addition is to the paragraph dealing with infiltration and leakage where the user is referred to the supplement for a tabulation giving infiltration allowance for revolving and swinging doors.

The paragraph dealing with noise control has been completely rewritten. It now reads as follows: "No noise resulting from the operation of an air conditioning system shall exceed the loudness level of the noise in the room when the normal activities in the occupied space are in progress and no part of the air conditioning system is operating. The loudness level of both the noise in the room and noise produced by the air conditioning system shall be expressed in decibels and measured with a sound level meter constructed according to American Tentative Standards for Sound Level Meters Z24.3—1936. Noise measurements shall be made at a height of five feet from the floor of the space to be air conditioned and no reading shall be taken closer than five feet from any wall, register face, window or ventilation equipment."

The final addition is the last paragraph following that on guarantees and labeled "Exceptions." This new paragraph reads: "If a proposed installation differs from the provisions of this code, the particular in which the design departs from the code shall be stated in the specifications and proposals."

### The Supplement

The first part of the supplement to the Chicago standards for comfort air conditioning is devoted to definitions. Such words as conductance, evaporator, infiltration, dewpoint, etc., being especially defined for purposes of the code. In the supplement air conditioning itself is defined as follows: " . . . [an air conditioning] system must incorporate not only devices for the control of the four factors, namely, temperature, moisture content, air movement, and cleanliness, but the system must control them within certain specified limits. These limits, with the exception of cleanliness, may be found in Sections 5, 6, and 12 of the Standards. Cleanliness includes the removal, from air, of particles causing odors as well as other suspended matter. The devices installed in a system of this kind shall have a dust arrestance of at least 85% when tested in accordance with the standards of rating contained in the ASHVE Guide. Devices for the control of odors should be effective to the extent that such odors are not noticeable to a person having a normal sense of smell and coming directly from out-of-doors."

The following table, included in the supplement, gives the approximate amount of heat in B.t.u. per hour dissipated by human beings in air at 70F:

| ACTIVITY | SENSIBLE | LATENT | TOTAL |
|---|---|---|---|
| At rest | 310 | 105 | 415 |
| Light work | 290 | 248 | 538 |
| Moderate work | 400 | 400 | 800 |
| Dancing | 470 | 530 | 1000 |
| Heavy work | 650 | 850 | 1500 |

In regard to noise control the supplement states that "To determine the normal noise level in the room, measurements shall be made in not less than ten different locations uniformly distributed on the plane and within the boundaries specified by these Standards. The numerical average of these measurements shall be taken as the normal noise level of the room."

As for insulation, the supplement requires that "The coefficient of heat transmission (U) of the insulation should be such that the heat transfer will be low enough so as to prevent the outer surface of the insulating material from attaining a temperature colder than the dewpoint temperature of the air surrounding it."

Included in the supplement are also several paragraphs covering such subjects as design air quantities, refrigerating apparatus and refrigerants, heat transfer apparatus, and permits. All of these paragraphs are tied in with the practice peculiar to Chicago and dealing with the relationship between engineering practice in that city and various local laws. Since they are of interest primarily to engineers in Chicago only, they are not reprinted here.

# EDITORIALS

## What is a Split System Now?

Whenever a new idea appears or when an old idea is reborn there is usually a tendency toward adopting descriptive words with little thought of the possible confusions. Such a case comes to mind in the recent revival of the use of the word *split* in residential heating.

This word was formerly widely used as meaning a system of heating and ventilating in which the heating was entirely separate from the ventilating to the extent that complete heating could be accomplished without any circulating air being used. When air was circulated it was for the purpose of accomplishing ventilation and, being brought from the outside, was heated to the temperature which was being maintained inside.

Recently, however, this meaning has been widely departed from when this word is used in connection with residential heating. Now some people refer to a residential plant as being *split* when part of the rooms are equipped with central air heating while part are heated by direct radiators. Others interpret a *split* as being accomplished when a direct-fired air furnace is used with a device for securing incidental steam or hot water in one or two rooms. The word is even occasionally used to indicate that heating and cooling are secured by separated equipment.

Thus, a word which formerly had a well-defined meaning is now being used to mean a number of different arrangements of equipment. It has gained wider use but only at the price of losing its sharp definition. We have all seen enough cases where this indiscriminate use of words finally results in their either losing all meaning entirely or else they come to mean so much that they lose all value in description. Remember the word *unit* and the phrase *air conditioning* as horrible examples of extending good words too far. Let's keep the word *split* confined to its older meaning, and try to avoid a like fate for it.

As a suggestion, why wouldn't the word *combination* be suitable where a residence has part of its rooms heated by central air and part by direct radiation? For our own part we don't see why there has to be a single word to describe these arrangements anyway, but if there must be one we ought to select a word not already in established use.

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## Competitive Fuel Equipment

Stokers are tending more and more toward becoming capable of fully automatic operation. This may not yet be apparent when judged by current installations but it is certainly obvious when one is aware of the study and effort being put on bin feeders, on automatic air controllers, and on devices for ensuring against outfires. If similar moves made during the development of oil burners mean anything, then it is predictable that we are going to see the automatic feature strengthened and promoted. Also we can be sure that the time will come, and it is not far off, when there will be little to choose between oil burner and coal burner so far as absence of personal attendance is concerned. At the same time first costs of the installed equipments are coming closer together and sales volumes are beginning to be comparable.

All these facts are full of meaning. For one thing they indicate a closer and closer competition for domestic fuel burning equipment. They mean more and more eliminations as the struggle gets really fierce. They mean that an increasing pressure will be put on good design and on economical marketing. They mean smaller and smaller differences between cost and sales price. In short, they mean that both oil burners and stokers for domestic purposes are about ready for the closing stages of the fight among the fuels which has been going so actively for the past twenty years.

Coal now stands in a relatively better competitive position than it has occupied since the automatic oil burner began to gain public acceptance. From now on it looks like a real battle, but not a battle of extermination. We are much inclined to the opinion that instead of a general massacre the struggle will end in some kind of draw.

Already there are significant moves among equipment manufacturers and among the marketing organizations. Prominent manufacturers are now making both oil burners and stokers and more are preparing to do so. Others are arranging for local handling and sale of both products indiscriminately. Engineers, contractors, and dealers may well take note of this situation.

We may be approaching a time when residence fuel equipment can be selected on the basis of costs and fitness to the job to be done, rather than on some of the hysterical arguments which have been advocated by partisans of each fuel. We believe that competition between oil and coal equipment on a basis of closely comparable first costs and similar performances will result in a situation greatly to be preferred to that existing when there is no such choice.

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## Summer Cooling Prospects

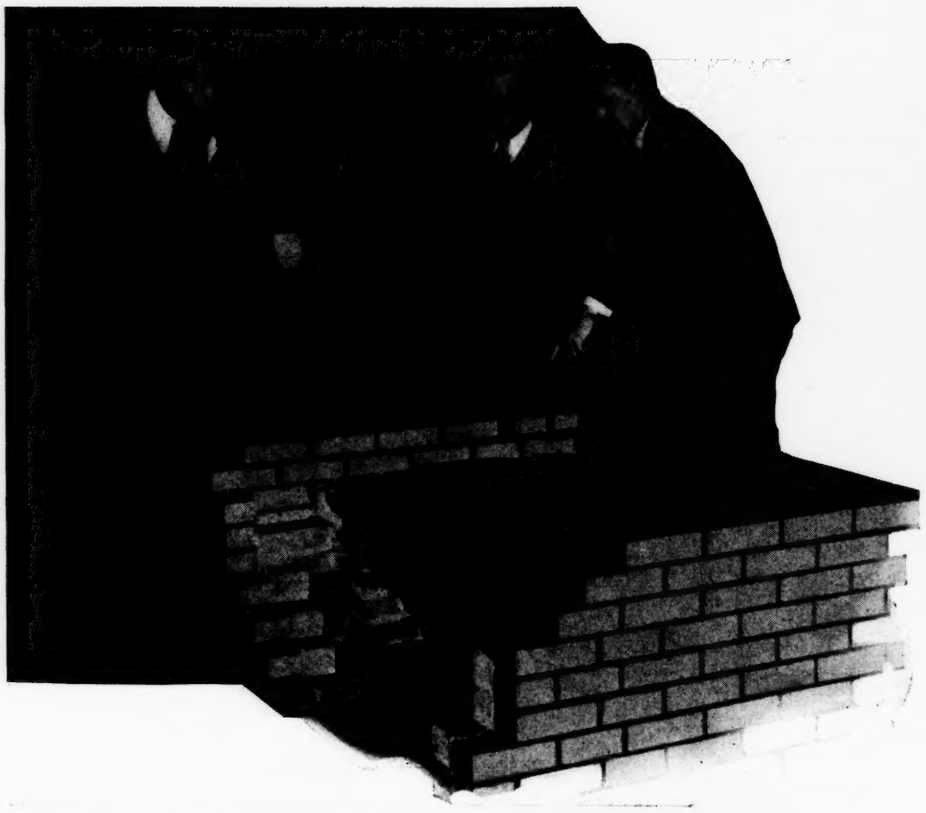
So far summer cooling for comfort in buildings has been a depression business and to a considerable extent a modernization business. Circumstances have forced this situation. Installations have been secured under handicaps which will probably not be present under more nearly normal conditions. These handicaps have made it necessary to adopt methods of securing installations which are distinctly specialized. These methods and times have caused some points about summer cooling marketing to stand out more prominently than would have been the case otherwise.

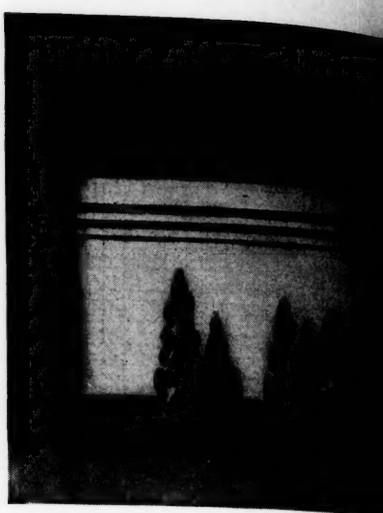
An examination of the record shows clearly that the installations have proceeded in waves in several kinds of buildings. Movie theaters and large stores led off; restaurants and other eating places furnished a considerable part of one summer's business; specialty stores and personal service shops furnished another's. As the better class of establishment in each group adopted cooling and as prospects thus fell off, enough installations had been made in buildings of other kinds to open up new avenues. Just now there are indications that apartment houses may be the next place where there will be an active interest. Hospitals are becoming increasingly interested. Pioneer installations have already been made in both types of buildings.

This hard necessity of searching out suitable places and encountering a limited number who would be interested in each group has not been without its compensations. The method has permitted intensive study of the requirements of each type of business and building and at the same time has permitted a diversification which is impressive.

Now there is a sizeable number of installations in a great variety of buildings in localities all over the country put in under all kinds of conditions and varying from very good to very bad jobs. Moreover, their operating results are being carefully watched. Probably much of this diversity would not have been accomplished under conditions which would have made selling easier and simpler.

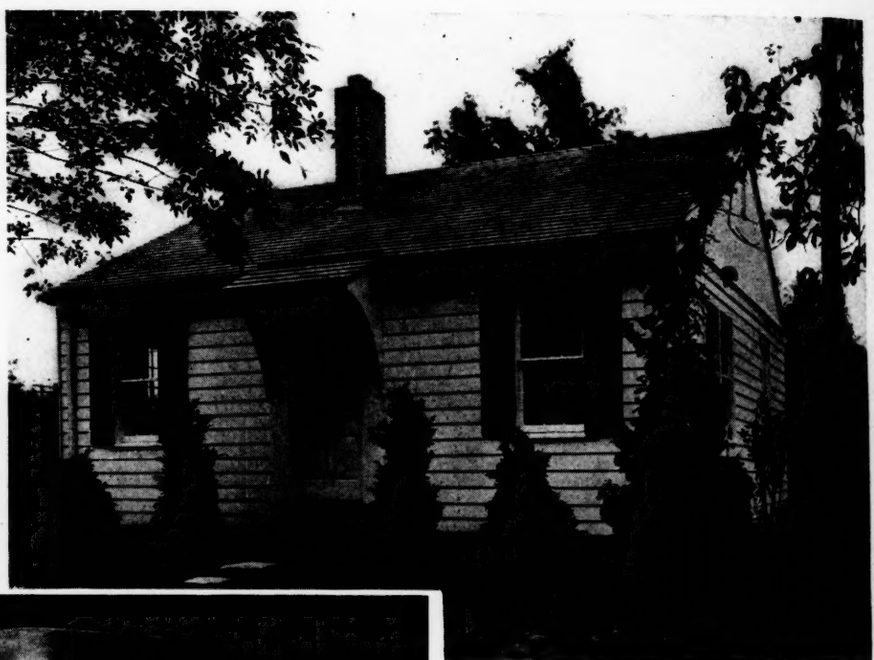
There is still a huge field left in this worked-over ground on which so much spade-work has been done. It will take but little improvement in circumstances to turn a considerable part into actual business. When this happens the compensation for all the spade-work done will be apparent to all. We believe that this forced specialization in finding installations during the depression years will yet prove to have been a blessing to summer cooling. To our way of thinking more volume will be found here in the next few years than in any expansion of summer cooling in homes.



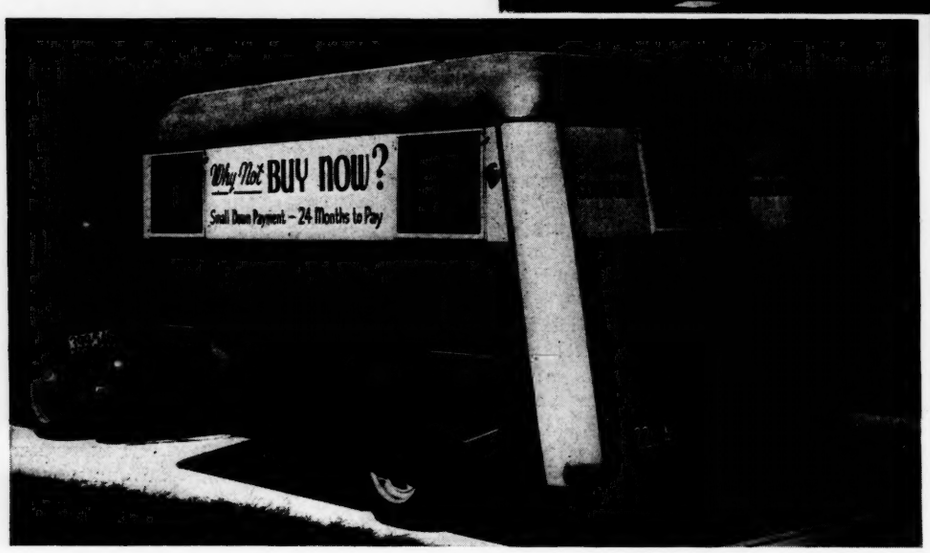


# PICTUR

**STOKERS FOR "BROWN BOMBER."** Joe Louis is investing his earnings as a fighter in Chicago apartments which he has modernized. He installed a Free-Man stoker in one of his apartments recently and ordered four more for other apartments which he owns on Chicago's south side.



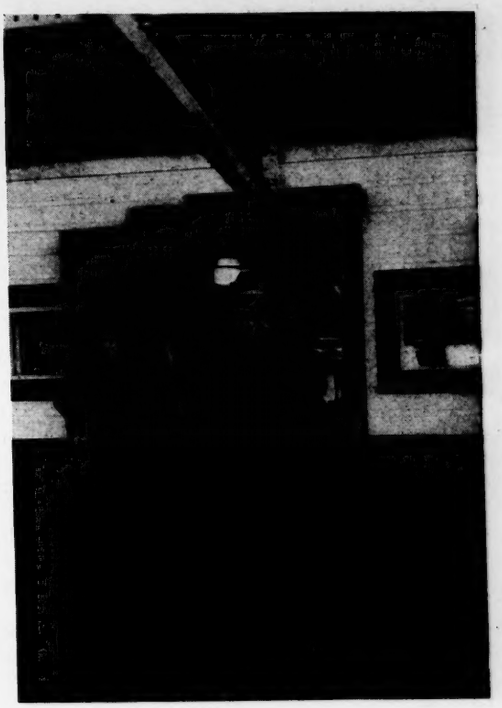
**6,000,000 OF THESE NEEDED!** (Right) According to the National Association of Manufacturers, the market for low-cost homes is enormous. The view shows a house developed by the National Lumber Manufacturers Association, one of three demonstration houses just completed at Bethesda, Md., and costing from $2500 to $2900. Less than $140 was allowed for the heating system, so that stoves were used.




**ECONOCOL TRAILER** takes to highways. Using a beautifully appointed trailer as a traveling showroom, Peter Hagen, distributor in southwestern Wisconsin and eastern Minnesota, is expecting to create considerable interest in stokers, both among dealers and consumers. Painted a rich maroon with cream trim, the exterior of the trailer carries an illustration of the streamlined stoker on the back and virtual billboards on either side. Inside, Mr. Hagen has a model wired up to demonstrate the working mechanism of the stoker and its controls.

**WINDOWLESS BUILDING** for National Aluminate Corp., Chicago, to house its industrial research laboratories and offices (left). Conditioned air will be supplied to each room all year round. Savings of approximately 20% in building costs are effected by omitting windows, and winter heating at — 10F can be accomplished solely through heating from illumination. Building designed by Ambrose C. Cramer, Inc. Robert E. Hattis, mechanical engineer of this firm, designed the air conditioning system.

# RAGRAPHS



**AIR CONDITIONED TESTING DEPARTMENTS** are being used at Westinghouse's East Springfield appliance manufacturing plant with excellent results. Rooms, as shown to right, are soundproof and practically airtight. Conditioning system removes heat emitted by appliances.

**WALTER P. CHRYSLER** looks over one of the new Airtemp air conditioning units in America's largest automobile showroom air conditioning system, in the Chrysler Building. Showroom occupies over 20,000 sq. ft. of space and has four air conditioning systems totaling 80 tons of refrigeration. In connection with the salon is a motion picture display room seating 150 people and conditioned by a 10-ton compressor. All four of these systems are coordinated and subject to the control of a master-submaster control unit. With Mr. Chrysler (left) is Pat Tierney (right) of Airtemp, Inc.

# NEWS OF THE MONTH

## Air Conditioning Bureau Formed in Dallas; Proposes to Inspect Plans before Installation

DALLAS, TEX.—Of interest to every heating and ventilating engineer in Texas is the recently created Texas Bureau of Air Conditioning and Standardization, a non-profit organization for the purpose of increasing air conditioning sales by affording the public a guarantee of proper installation and operation of equipment.

A charter was granted by Secretary of State B. P. Matocha October 23 to three incorporators, F. W. Rabe, consulting engineer, Millard F. Willis, attorney, and Dr. F. S. Frederick, all of Dallas. Definite plans for putting the bureau into operation are now being considered by committees appointed November 20 at a conference in the Adolphus Hotel here.

It is proposed to build up public confidence in the air conditioning industry through its cooperation with the bureau, which would pass on all plans before actual installation was begun and again before the work was announced complete.

It is the intention of the committee to draw up definite plans for the method of checking to be employed—recognized local consulting engineers might appoint one of their own number to serve part time and for a certain term, or a competent man might be hired as an inspector. Another committee is to formulate means of financing the bureau.

Although the bureau will function only in Dallas, or among Dallas firms to start out with, it is hoped that the idea will rapidly spread over the state and gain in prestige until it becomes known to the public in general. It has no intention, at least at present, of promoting legislation requiring certificates of approval by inspectors before the jobs are installed, but it is hoped that the people themselves will come to rely on it to such an extent that failure of a contractor to show a certificate of approval will be tantamount to loss of the job.

In addition to promoting the industry by guaranteeing the public proper installation, the bureau would sponsor surveys of local conditions to determine in what ways the public could be better served and the industry itself benefited.

Representatives from a score of air conditioning equipment manufacturers, contractors, and engineers attended the conference. Previously, separate meetings of each of these groups were held in the office of Mr. Rabe to sound them out as to their ideas on such a bureau. With a few exceptions the plan was heartily backed.

Members of the standardization committee are H. O. Smith, manager of the Texas Bureau of Inspection; Mr. Higgins, local manager of the Baker Ice Machine Co., Fort Worth; J. Bishop, local manager of the American Blower Co.; J. Berry, General Electric Co.; James Van Sickle, Murray Co.; Sam Wallace, Wallace Heating & Plumbing Co.; H. L. Jones, Frigidaire; and Mr. Rabe.

Members of the finance committee are J. E. Bush, head of the Viking Air Conditioning Co., Dallas; Henry Martyn, and William Henger.

## Plumbing and Heating Industries Bureau Holds Annual Meeting

CHICAGO—More than 250 representatives of the 40 associations and groups of manufacturers, wholesalers, and contractors constituting the Plumbing and Heating Industries Bureau attended the annual business meeting of the Bureau here October 28.

Reports were made by John J. Calnan, president; Charles K. Foster, executive vice-president, American Radiator Co., treasurer; A. C. Brown, president, Chicago Faucet Co., chairman of the finance committee; and Norman J. Radder, secretary.

Following Mr. Brown's report in which he urged associations to make their 1937 pledges for the Bureau as soon as possible and to increase the amounts over last year, the Central Supply Association, which was holding its annual meeting at the same time as the Bureau, voted to increase its 1937 subscription 66 2/3% over the 1936 contribution.

Speakers included George H. Werner, president of the National Association of Master Plumbers; Harry C. Yelton, president of the Central Supply Association; and C. B. Nash, chairman of the manufacturers' committee of the convention and exposition of the National Association of Master Plumbers.

## Steele Heads Chapter

WINNIPEG, MAN.—The newly organized Manitoba chapter of the ASHVE, began activities recently when it held the first meeting of the season in the Fort Garry Hotel. The feature of the meeting was an address by international President G. L. Larson.

Chapter officers are: John B. Steele; vice-president, D. F. Michie; secretary, C. H. Turland; treasurer, Hugh R. Eade: Board of Governors, Frank Thompson, William Glass, and J. E. Yates.

## Underwriters' Laboratories Reorganized

CHICAGO—To clarify its position as a non-profit service corporation, Underwriters' Laboratories has been reorganized without capital stock. The National Board of Fire Underwriters, which contributed to the original cost of the enterprise and under the direction of which it was established and has been maintained, continues its sponsorship.

The new charter recites among the objects: "By scientific investigation, study, experiments, and tests, to determine the relation of various materials, devices, constructions and methods to life, fire and casualty hazards, and to ascertain, define and publish standards, classifications and specifications for materials, devices, construction and methods affecting such hazards, and other information tending to reduce and prevent loss of life and property from fire, crime, and casualty."

## 35 Enroll at Montreal

MONTREAL, QUE.—The opening meeting of the season for the Montreal chapter of the ASHVE was well attended and much enthusiasm was shown in the new organization. The guest of honor was international President G. L. Larson, who delivered an informative address on "Good Construction as Related to Residence Heating."

Thirty-five members are enrolled in the chapter.

## Fernald Heads RMA

WASHINGTON—J. M. Fernald, general manager of the Baker Ice Machine Co., Inc., Omaha, was elected president of the Refrigerating Machinery Association at its annual meeting here November 13.

Following service in the war, Mr. Fernald was first sales engineer and later New England district manager for the Cutler-Hammer organization. During that time Mr. Fernald gained particular recognition for industrial research. But with the art of mechanical refrigeration beginning its commercial development and spectacular growth in 1926, Mr. Fernald turned his talents to that field, becoming associated with the Electric Refrigeration Corp. (later Kelvinator) as assistant director of commercial sales. Within two years he was appointed head of the commercial refrigeration division of Kelvinator and left that position to become general manager of Baker Ice Machine Co. Last June he was elected president of the Omaha Manufacturers Association.

## Gas Men Hold 18th Annual Convention at Atlantic City

ATLANTIC CITY — "House-Heating Progress during 1936" was the subject of a symposium at the meeting of the commercial section of the American Gas Association convention, October 29. Included in this symposium were B. T. Frank, American Light & Traction Co., Chicago; H. O. Loebell, chairman of the house-heating and air conditioning committee, and E. H. Lewis, St. Louis County Gas Co., Webster Groves, Mo.

Among the speakers before the same section at its meeting October 27 were Hugh Cuthrell, Brooklyn Union Gas Co., Brooklyn, N. Y., and George L. Bird, secretary, National Association of Master Plumbers. Mr. Bird said:

"On several other occasions representatives of the National Association of Master Plumbers have appeared at meetings of the American Gas Association and urged cooperation between the members of the two groups. These appearances have, I believe, contributed in a large degree to the growing number of mutually profitable relationships between the two groups. My purpose in coming here today is to reemphasize the need, both from your point of view and from ours, of even greater cooperation for mutual profit.

"While both your group and ours, in principle at least, agree that cooperation is a desirable thing, we are not necessarily in agreement on the details of an arrangement which would be mutually profitable and satisfactory. All too many Master Plumbers seem to think that their licenses alone permit them to stand at the threshold of every consumer's house and extract a tribute for all of the gas equipment which enters the door. These short-sighted men wish to exact that tribute without performing any function to facilitate the entry of the gas appliance into the home or to its service once it is in. On the other hand, there are gas utilities who seem to feel that the Master Plumber should be happy to push the sale of gas appliances for the secondary profit he derives through establishing consumer contacts. Needless to say, I am not in sympathy with either of these views.

"As I see the situation, there are certain fundamentals which characterize those satisfactory agreements which are now in effect. I shall enumerate them as follows:

"1—A written understanding between the gas utility and the Master Plumbers as opposed to a mere verbal understanding.

"2—A clear distinction in the written understanding, as to what constitutes an actual sale, what constitutes help to a gas utility salesman, and what constitutes development of sales prospects or 'leads' as they are popularly known.

"3—A graduated scale of monetary reward dependent upon the type of service the Master Plumber renders in the consummation of the sale.

"4—A clear-cut understanding as to who, and under what conditions, is to make the installation of the appliance.

"In an analysis of the complaints our National Association has received from its constituent bodies on the lack of cooperation between themselves and the gas utilities, I find that in all instances the complaint is based on the disregard of one or more of the four factors I have called to your attention. Either through your fault or ours we have disregarded these four factors in one respect or another, with the result that instead of a harmonious and mutually helpful relationship to extend the satisfactory use of gas we find, in some instances, our two groups at loggerheads with a resultant lack of profit to either of us, and a diversion of business to other fuels.

"I should like to propose something which has been proposed before, but never favorably acted on. I should like to propose that the Commercial Section, or the American Gas Association, appoint a committee of not over two men to meet with a similar committee appointed by our Association, for the purpose of developing one or more typical agreements between our two groups which could be offered to our respective units as a guide, or statement of principles, for the establishment of satisfactory relationships. All negotiations must have some basis, and such basic principles as I believe a joint committee could work out would be most helpful.

"It may appear presumptuous on my part to make this suggestion, but I feel that the gravity of the situation is such that someone has to start; and I appeal to you commercially-minded men—you sales-minded men—not to overlook the help you can receive from the thirty-odd thousand Master Plumbers throughout the country. Our Association stands ready to appoint a committee and appropriate sufficient money for the necessary studies and conferences. I ask that your group or your Association do likewise."

At the meeting of the industrial section, C. W. Swenson, of the Consolidated Edison Co. of New York, described "A Recapitulation of the Progress Made in Applying Air Conditioning to Industrial Plants." Mr. Swenson discussed gas-operated drying equipment, and stated that dehumidification with gas could be operated more cheaply and was more responsive to control than other methods. Among three profitable industries where gas dehumidifying can be utilized, he mentioned printing and lithography, lacquering, and pharmaceuticals. Among the outstanding advantages of gas dehumidification as brought out by Mr. Swenson were: independent control of both humidity and temperature; accuracy and ease of obtaining this control; lower operating cost, and the short time required for writing-off the initial cost.

## Warm Air Program Complete

COLUMBUS—National Warm Air Heating and Air Conditioning Association has released the final program for its December convention to be held at the Stevens Hotel, Chicago, December 15-17. The convention sessions will be held on the 16th and 17th, with committee meetings scheduled for the 15th. Registration will begin at 8:30 a.m., December 16.

The program follows:

DECEMBER 16—a.m.

Through Your President's Glasses, President W. L. Rybolt, Ashland, Ohio.

What An Opportunity, Bennett Chapple.

What Shall It Profit Us?, Dana W. Norris, Syracuse, N. Y.

New Merchandising Methods Needed for the New Heating Era, Oliver Gedeist, Dowagiac, Mich.

The Robinson-Patman Act, Arthur P. Lamneck, Columbus, Ohio.

DECEMBER 16—p.m.

Our Installation Codes, Prof. J. D. Hoffman, committee chairman, Purdue University.

Research Advisory Committee Report, F. G. Sedgwick, chairman, Minneapolis, Minn.

The Calculation of Cooling Load for Installation of Summer Cooling Systems, A. P. Kratz, research professor, University of Illinois.

Summer Cooling in the Research Residence Using Water at 50F and 46F, S. Konzo, special research associate, University of Illinois.

DECEMBER 17—a.m.

Combined Salesmanship and Engineering Imperative, Frank G. Herman, Oshkosh, Wis.

Servicing Today a New Problem, Frank L. Myers, Toledo, Ohio.

Summer Cooling Using Well Water, C. D. Leiter, Ashland, Ohio.

## Philly Observes Anthracite Week

PHILADELPHIA—The week beginning November 16 was designated Anthracite Week by Mayor Wilson and during that week a complete display of anthracite-burning equipment was offered to the general public in a showroom at Broad and Brown Sts.

Manufacturers who exhibited included Dickson & Eddy; Cooper & Cooper; G. B. Newton Coal Co.; Electric Furnace-Man, Inc.; Hershey Foundry & Machine Co.; Iron Fireman Manufacturing Co.; Delaware, Lackawanna & Western Coal Co.; Link-Belt Co.; Automatic Florozone Heating Co.; American Radiator Co.; Fitzgibbons Boiler Co., Inc.; Spencer Heater Co.; Crane Co.; H. B. Smith Co.; Burnham Boiler Corp.; International Boiler Works Co.; Richardson & Boynton Co.; Taco Heaters, Inc.; The Mercoid Corp.; Cook Electric Co.; Freed Heater Co.; and Minneapolis-Honeywell Regulator Co.

### 12th Welding Conference Scheduled

LAFAYETTE, IND.—The 12th annual conference on welding will be held at Purdue University here, December 10-11. The conference will be held in the Department of Practical Mechanics Building and will include, among other features, the following: "A Survey of the Development of Fusion Welding," by J. M. Jardine, Western Welding and Boiler Repair Co., Chicago; "The Electric Welding Arc in Action," by E. W. P. Smith, The Lincoln Electric Co.; a sound film, "The Manufacture, Fabrication and Applications of Enduro Stainless Steels," by T. R. Lichtenwalter, Republic Steel Corp.; and "The Role of Electrode Material in Resistance Welding of Ferrous and Non-ferrous Sheet Metal," by E. I. Larson, P. R. Mallory & Co., Inc.

### Joins Purdue Staff

NEW YORK—J. M. Krappe, formerly with the American Gas Association headquarters here, has been appointed an associate in gas research at Purdue University. Mr. Krappe will be in charge of the research work formerly handled by Prof. R. B. Leckie, who resigned recently to become associated with Air Controls, Inc.

### Wetzell Addresses Cleveland Group

CLEVELAND—H. E. Wetzell, chairman of the standards committee, led a discussion on "Air Conditioning Standards for the Cleveland Area" at the October 20 meeting of the Cleveland Chapter, ASHVE.

F. A. Kitchen, chairman of the legislation committee, spoke on the State of Ohio code rule 19, pertaining to ventilation requirements in public buildings. C. B. Carey reviewed the present air conditioning standards of the Buffalo Chapter.

Philip Cohen was unanimously elected vice-president succeeding F. R. Dickenson who has resigned due to having left the city. W. R. Beech was elected to succeed Mr. Cohen as secretary.

### More A. C. Cars for L. & N.

BIRMINGHAM, ALA.—The Louisville & Nashville Railroad has appropriated $800,000 for the air conditioning of 80 all-steel coaches and three dining cars. The equipment is to be installed in the Louisville shops of the company and will be ready for service next spring.

With the 30 coaches and 13 diners thus equipped last summer these will provide completely air conditioned service on practically every L. & N. main line train, except a few locals.

### $25,000 Budget for National Bureau of Heating and Air Conditioning

CHICAGO—A budget of $25,000 for 1937 operations of the National Bureau of Heating and Air Conditioning was adopted at a general meeting here October 28. The meeting was attended by manufacturers and contractors as well as members of the board of directors of the National Bureau of Heating and Air Conditioning. Of the $25,000, $10,000 will be used for the establishment of a research program.

The board of directors at a subsequent meeting acting on the basis of the decision of the general meeting decided to proceed with the program of nationalizing the Chicago campaign as soon as funds have been raised.

Coincident with the meeting, the copy committee announced the appearance of a consumer booklet and the first two pieces in a consumer mailing campaign. "Personalized Weather As You Like It" is the title of the consumer booklet.

### House Construction Discussed by Larson

BOSTON—Members of the Air Conditioning Bureau of Boston and the Boston chapter, ASHVE, held a joint dinner and meeting November 13. Prof. James Holt, Massachusetts Institute of Technology, the new president of the Boston chapter, presided. Prof. G. L. Larson, national president, ASHVE, and head of the mechanical engineering department at the University of Wisconsin, was the guest speaker. His subject was "Economics of Good Construction as Related to Residence Heating." Professor Larson dwelt mainly upon heat loss in residences under various conditions of insulation.

### Pattison Banquet Chairman

NEW YORK—Gardner Pattison, president of Burns Bros., will be general chairman in charge of the annual banquet of the Anthracite Club to be held at the Astor Hotel, January 14. Thomas F. Farrell, president of the Farrell Coal Co., will act as toastmaster.

### A.C. Apartment for the Philippines

NEWARK, N. J. — Philippine Islands now has a completely air conditioned apartment, the Rosario, at Manila. Occupancy started November 1, with rentals completed several months in advance. One half of the building will be served by Carrier air conditioning as a standard feature, while the remaining tenants may have air conditioning as desired.

### Larson Speaks at Toronto

TORONTO, ONT.—The opening meeting of the season was held recently by the Ontario chapter, ASHVE, in the society's club rooms, a feature of which was the visit of President Larson, head of the parent body. He was accompanied by Secretary A. V. Hutchinson.

T. McDonald, president of the chapter, presided. Over 50 members and guests were present.

### Gas Heating Up

NEW YORK — During the first ten months of 1935 the Brooklyn Union Gas Co. sold 25 house heaters. In the same period in 1936, 515 heaters were sold, an increase of nearly 2000% according to the new business department of that utility.

## OBITUARIES

### Lee B. Mettler

LOS ANGELES—Lee B. Mettler, head of the Lee B. Mettler Co., combustion engineers and manufacturers of gas burners, of 406 S. Main St., this city, died November 13 of a severe heart attack. He had been ill for some time.

Mr. Mettler was born in Adrian, Mich., December 7, 1874, and had been associated with the gas industry for many years having begun his own company 15 years ago.

### J. R. McColl

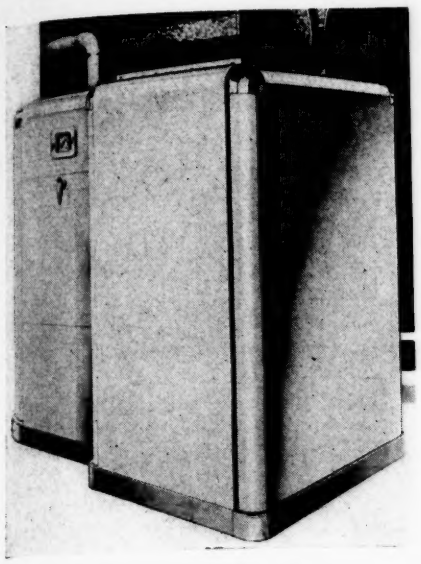
DETROIT—J. R. McColl, member of the firm of McColl, Snyder and McLean, engineers, passed away early Friday, October 30, at his home after an illness of six weeks. He was 69 years of age. He was a member of the ASME, past president of the ASHVE, past president of the local ASHVE chapter, past president of the former Detroit Engineering Society, and past president of the Michigan State College Alumni Association.

He was a member of the faculty of the University of Tennessee for eight years, and served three years on the staff at Purdue University. In 1911 he was made dean of the engineering college of the University of Detroit.

### Arthur W. Clark

NEW YORK—Arthur W. Clark, formerly secretary of the Dealer Division of the National Oil Burner Association and who later organized the National Oil Burner Dealers Association, died suddenly in his home in Freeport, Long Island, November 7. He was 52 years old.

# NEW EQUIPMENT



## Fitzgibbonsaire Conditioner

NAME—Fitzgibbonsaire.

PURPOSE—A floor unit plenum chamber for use with heating boilers to provide the functions of winter air conditioning.

FEATURES—The unit contains a double inlet blower, a spray nozzle, humidifier, and heat exchangers. Its design permits its location in any desirable place in the basement regardless of the location of the boiler.

CAPACITIES — From 91,300 to 461,700 B.t.u. per hr.

MADE BY—*Fitzgibbons Boiler Co., Inc., 101 Park Ave., New York.*

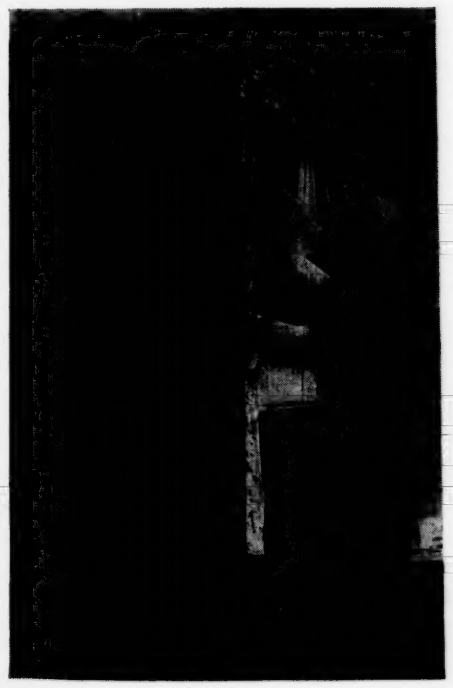
## Airtemp Air Conditioner

NAME—"All-in-one" summer air conditioner.

PURPOSE—A complete summer type air conditioning unit for shops, stores, and offices.

FEATURES—Manufacturer states that while the new unit has a 3-hp. capacity it is of such compact design that all machinery is contained in one cabinet which covers only 20 x 33 in. of floor space. The unit is 7 ft. 6 in. high and has a diffusion type grille near the top. Approximately 1200 cu. ft. of air per minute can be circulated. The unit is semi-portable so that the merchant or shop owner can take it with him when he moves. Only electrical and water connections are required. Unit can be installed in multiple to take care of a wide variety of loads. In these multiple installations each unit works independently of the others.

MADE BY—*Airtemp, Inc., New York.*



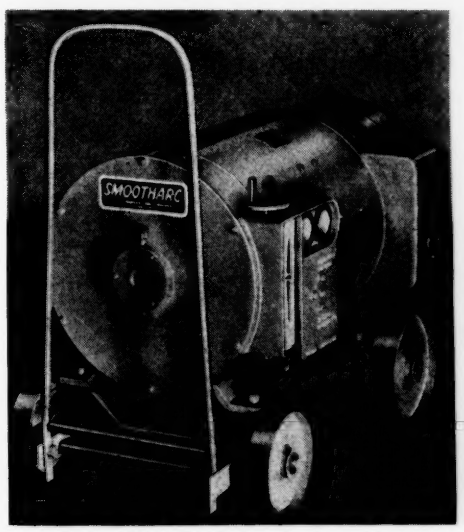
## P & H-Hansen Smootharc Welders

NAME—P & H-Hansen Smootharc welders.

PURPOSE—For electric welding.

FEATURES—A single automatic current control is used to control the operation of this welder. Patented stabilizing coils imbedded in the main pole flanges of the generator are said to result in a high degree of arc stability. Other features include all controls centrally grouped, one-way positive ventilation, close coupled contact designed, all welded construction, drip-proof enclosure.

SIZES—Available in a wide range of sizes and




mountings from 75-600 amperes.

LITERATURE AVAILABLE—Bulletin No. W-8.

MADE BY—*Harnischfeger Corp., Milwaukee, Wis.*

## Vigor-Aire Humidifier

NAME—Vigor-Aire humidifier.

PURPOSE—For humidifying an average 8- to 10-room residence or office.

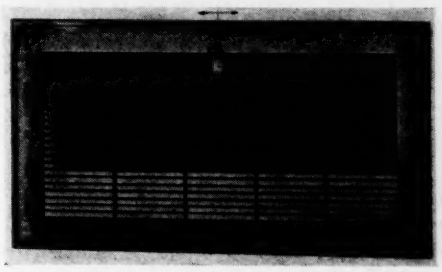
FEATURES—Manufacturer says this device is self-filling, automatically controlled, and evaporates up to 12 gal. of water per day. It is said that the unit costs about one cent a day to operate. It is designed to fit on any convenient radiator or installed near a warm air register.

MADE BY—*Vigor-Aire Corp., 127 S. Fifth St., Philadelphia, Pa.*

## United States Close-Space Air Conditioning Register

NAME—United States Close-Space air conditioning register.

FEATURES—Narrow deep fin bars obstruct all view of the interior. A special screw at the top of the register and back of the operating levers limits the opening of the damper for any desired volume, yet permits closing of



the damper after the register is adjusted and set with this recessed screw. The set screw is covered with paint when the register is finished. The depth of the fin bars is ¾ in., spacing is 3/16 in., and the width of the dampers 1 in.

MADE BY—*United States Register Co., Battle Creek, Mich.*

## Mercoid Stokatherm

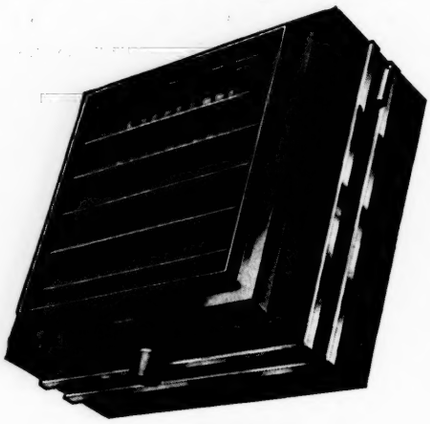
NAME AND MODEL NUMBER — Mercoid Stokatherm, type JMV.

PURPOSE—For controlling the operation of coal stokers.

FEATURES—According to the manufacturers, the Stokatherm performs four distinct functions: (1) fire maintaining; (2) out-fire operation; (3) limits overheating; (4) increased fuel savings. The transformer relay is in principle a low voltage transformer but also operates as a repulsion relay. The manufacturer states that rattling noises due to uneven, dirty or rusty armature faces, cannot occur as the transformer does not employ a clapper type iron armature. The timer is actuated by a self-starting synchronous motor with heavy cut brass wheels having pinions of tool steel. The temperature actuated mechanism responds to changes in stack temperature and by means of a mechanical interlock controls the starting of a timer interval period. After the given time period has elapsed with no operation of the stoker, the control automatically puts the stoker into operation to maintain the fire. The temperature actuated mechanism operates on a temperature differential. Mercoid mercury contact switches are used throughout.

LITERATURE AVAILABLE—Bulletin 242-A.

MADE BY—*The Mercoid Corp., 4201 Belmont Ave., Chicago, Ill.*



## Airvector Unit Heater

NAME—Airvector unit heater.

PURPOSE—For space heating.

FEATURES—Exclusive features claimed for this unit heater include a new method of motor mounting which is said to eliminate swinging or "pendulum" action of the unit caused by motor vibration; the forming of two vertical ribs around the cabinet which increases the strength and at the same time has a deadening action on the vibration of the cabinet panels; welded construction wherever practicable.

SIZES—A full range of unit heater capacities is available.

LITERATURE AVAILABLE—Catalog No. P-7 contains complete details.

MADE BY—*Airtherm Manufacturing Co., 1474 S. Vandeventer, St. Louis, Mo.*

## General Pressure Regulator and Solenoid Valve

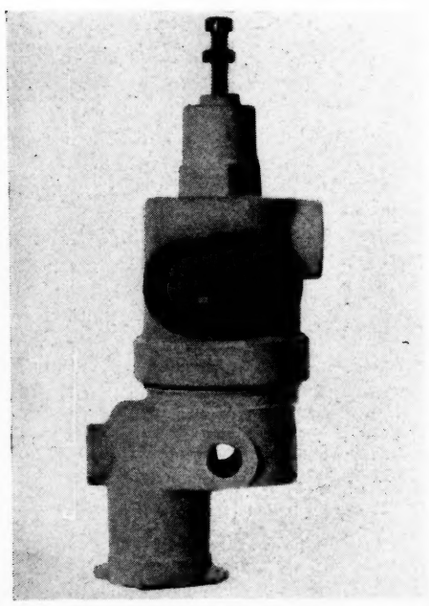
NAME AND MODEL NUMBER—Water pressure regulator and solenoid valve, model D.E.

PURPOSE—Valve is designed for application where it is necessary to control electrically the flow of water or air and also necessary to control the pressure at which the fluid is delivered from the valve.

FEATURES—The solenoid coil is manufactured by a patented process which is said to seal the windings against the entrance of moisture. Valve body is of cast bronze and the diaphragm is made of canvas and rubber. Non-corrosive materials are used for the valve and spring. A large area, fine mesh strainer of monel metal is incorporated in the valve. The standard adjusting spring allows delivery pressure to be maintained at any point from 5 to 50 lb. with a maximum pressure of 100 lb.

SIZES—¼ and ⅜ in. I.P.S.

MADE BY—*General Sales & Products Corp., 75 Mohawk St., Cohoes, N. Y.*

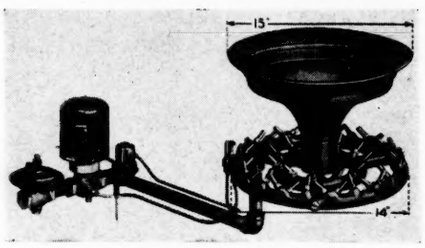


## Barber Conversion Burners

NAME—Barber conversion burners.

PURPOSE—Conversion burners for the combustion of gas in round furnaces or boilers having grates up to and including 20 in. in diameter.

FEATURES—Deflection of heat to the side walls is accomplished by a semi-steel deflector with a deflector ring which produces a scrubbing action of the flame on the side walls.



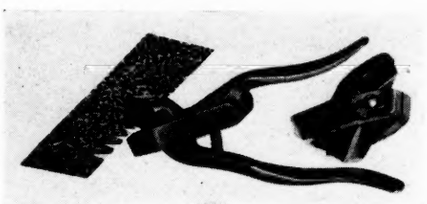

These burners are said to require no refractory elements. The assembly shown (No. X44-B) includes all equipment for automatic control. Burners are also furnished for manual control.

MADE BY—*Barber Gas Burner Co., Cleveland, Ohio.*

## Whitney "Notcher"

NAME—Whitney "Notcher."

PURPOSE—A sheet metal notching tool for cutting out beaded corners, edges of curved seams, and the like.



FEATURES—Die is made up of two pieces of hardened tool steel and has full clearance so that the punchings can drop through. Mounted on the right side of the die is a double depth gage which indicates the depth of the notch to be cut. The handles are of steel forgings, finished in machine tool grey lacquer.

MADE BY—*Whitney Metal Tube Co., Rockford, Ill.*

## Durakool Mercury Switches

NAME—Durakool mercury switches.

PURPOSE—A mercury switch for breaking and completing circuits in control and indicating apparatus.

FEATURES—The manufacturer states that this type of mercury switch opens and closes at exactly specified angles and that these angles will not only remain the same throughout the life of the unit but are also independent of the load. The switch is encased in a metallic envelope which is surrounded by molded bakelite insulation. It is said that the electrical clearances are such that when the switch is installed in wet places, there is no chance of leakage or flash-overs. In place of the usual gas, this switch utilizes a liquid fill. Due to the use of the metallic envelope, it is claimed that the switch will continue to operate even though the envelope is dented.

LITERATURE AVAILABLE—Bulletins Nos. 100 and 300.

MADE BY—*Durakool, Inc., 1010 N. Main St., Elkhart, Ind.*

## Anderson Combination Trap

NAME—Super-Silvertop combination thermostatic and inverted bucket trap.

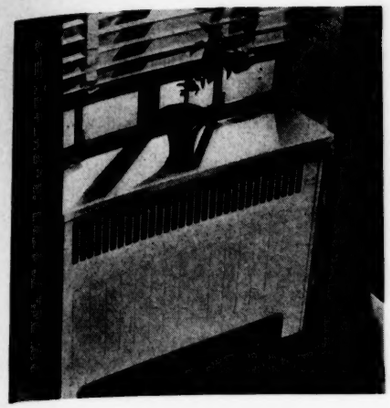
PURPOSE—To completely remove air and condensate from steam systems even at extremely low pressures.

FEATURES—Manufacturer states that in these traps, air is bypassed around the water seal and therefore slight pressure differentials are sufficient for operation. The entrained air causes the bellows to contract, opening a bypass and allowing the air to pass directly to the return line without going through the water seal. The trap has a valve and seat made of Anderloy. It is said that the return line can be run higher when this trap is used since both the inlet and outlet of the trap are in the head. Traps can be used on systems with pressures from a fraction of an ounce up to 50 lb.

SIZES AND CAPACITIES—Available with pipe connections up to 1¼ in. and with capacities up to 10,200 lb. at 15 lb. pressure.

LITERATURE AVAILABLE—Bulletin No. 1036.

MADE BY—*The V. D. Anderson Co., 1935 W. 96th St., Cleveland, Ohio.*



## Arco Enclosures

NAME—Arco enclosures.

PURPOSE—An enclosure for the Arco radiant convectors.

FEATURES—This convector was designed to provide radiant heat for the Arco concealed radiator and to retain at the same time all the advantages of the standard convector, including those of concealed radiators, space economy, and accessibility for cleaning. A live radiant heat panel of cast iron replaces the front section of a regular fin type convector heating unit so that this panel can be fitted flush to an especially prepared opening in the enclosure. The plate is finished in a priming coat of grey and can be painted with the enclosure. The installation practice is the same for the company's regular convector units.

MADE BY—*American Radiator Co., 40 W. 40th St., New York.*

## G-E Thermostat Control Wire

NAME—G-E thermostat control wire.

FEATURES—The wire incorporates exclusive Deltabeston design features and non-combustible insulating materials. Purified asbestos, applied by a special process, is used to insulate the flexible copper conductors. A rustproof, cadmium plated armor is wound around the asbestos-insulated conductors to provide protection for the wire while in service.

MADE BY—*General Electric Co., Bridgeport, Conn.*

## Dunham Adjustable Regulating Valve

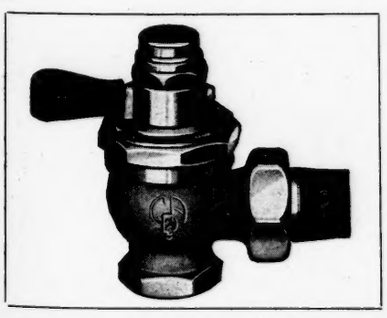
NAME AND MODEL NUMBER—Dunham adjustable radiator valve, type 174.

PURPOSE—A regulating valve containing an adjustable regulating plate which makes it possible to change the size of the orifice without disconnecting the radiator.

FEATURES—Valve is designed for use with the Dunham Differential vacuum heating system. Valve is said to be adaptable to existing heating systems where heating satisfaction is low because of lack of balanced steam distribution. The valve is said to be particularly valuable where the heating requirements of one or more areas in a building are changed by the repartitioning of floors. The manufacturer states that the bellows diaphragm construction makes the valve packless and leakproof and that neither steam, air, water, nor sediment can come in contact with the adjusting or operating mechanism.

SIZES—Valve is available in all styles and patterns. It can be furnished in lever and wheel handle, or lock and shield type and in angle, straightway, right hand, and left hand patterns for each of these types. Can also be furnished with a special extension stem where the valve is installed behind a grille.

MADE BY—*C. A. Dunham Co., 450 E. Ohio St., Chicago.*

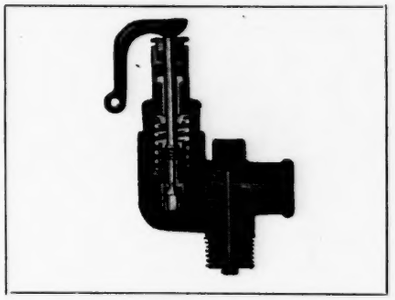


## Watts Pres-Tem-Vac Valve

NAME AND MODEL NUMBER—Watts Pres-Tem-Vac valve, No. 20.

PURPOSE—A combined pressure, temperature, and vacuum relief valve.

FEATURES—The pressure and vacuum relief features are incorporated in a single unit located at the top of the valve body. The whole unit can be removed in a few minutes for cleaning. The pressure relief feature is adjustable. Standard setting is 125 lb. with an adjustment range of 50 to 150 lb. The vacuum valve opens on the slightest vacuum. The temperature element is completely separated from the pressure vacuum relief of the valve and the fuse plug stem can be removed from the valve without disturbing the pressure adjustment and without removing the valve from the line. Valve is built of bronze and other non-corrosive metals.



MADE BY—*Watts Regulator Co., Lawrence, Mass.*

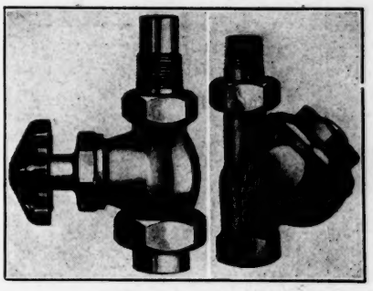
## Marsh Vertical Valves and Traps

NAME—Marsh vertical packless radiator valves and thermostatic traps.

PURPOSE—Especially designed for installation with concealed or cabinet type radiators.

FEATURES—The radiator globe valve is designed for use on steam, vapor, or hot water systems where a vertical or straightway connection can be used. It embodies the same all-metal packless construction feature which is standard on other valves of this company. The double union feature allows for simple installation in the closest connection. The extended tailpiece, a special feature for bottom connected radiators, extends into the radiator and prevents the accumulation and return of condensation through the supply valve.

The vertical trap has a thermostatic element which is identical with those used in the Marsh No. 1 traps and is interchangeable with them. It is said that the trap is non-freezing because of the perfect drainage of condensation from the body. The cap is removable without disconnecting the body from the piping connections.



SIZES—Valves and traps are available in ¾-in., 1 in., and 1¼ in. pipe sizes.

LITERATURE AVAILABLE—Form No. 536.

MADE BY—*Jas. P. Marsh Corp., 2073 Southport Ave., Chicago, Ill.*

## Westinghouse Steam Turbine

NAME AND MODEL NUMBER—Steam turbine, type C.

PURPOSE—An impulse type turbine for driving pumps, forced and induced draft fans, compressors, and similar apparatus; either direct connected or through gear or belt drive.

FEATURES—These turbines are for driving general purpose machinery and auxiliary equipment. They are of the impulse type having one pressure and two velocity stages and are suitable for use with steam pressures up to 750F. May be operated either condensing or non-condensing with rotation in either direction.

SIZES AND CAPACITIES—In 5 to 500 hp., at speeds of 1,000 to 5,000 r.p.m.

MADE BY—*Westinghouse Electric and Mfg. Co., East Pittsburgh, Pa.*

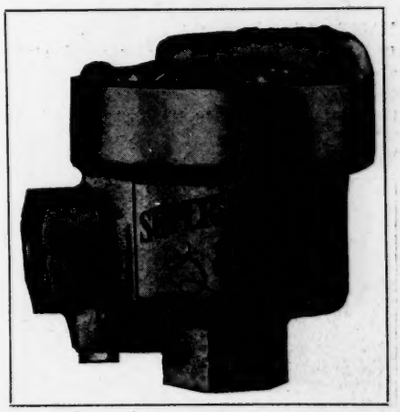
## Anderson Super-Silvertop Steam Trap

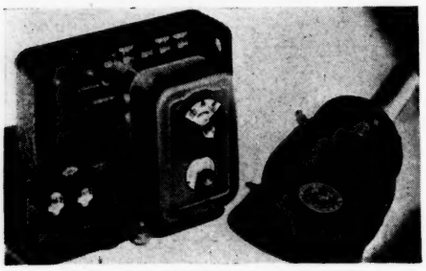
NAME AND MODEL NUMBER—Super-Silvertop No. 10.

PURPOSE—A steam trap designed expressly for small steam-using units such as unit heaters, sterilizing equipment, radiators, and steam tables.

FEATURES—Valve and seat are made of Anderloy which is a hard, chrome alloy. Bucket is made of one piece copper and all working parts are of stainless steel. Manufacturer states that no strainer is necessary since trap handles ordinary dirt and scale. The unit can be inspected, cleaned, or disassembled without removing from the line. Can be used on any steam pressure between 0 and 125 lb.

MADE BY—*The V. D. Anderson Co., 1935 W. 96th St., Cleveland, Ohio.*





## Iron Fireman Pyrometric Control

NAME—Iron Fireman pyrometric control.

PURPOSE—To meter coal to the fire on the basis of both time and temperature.

FEATURES—The control is said to make the most of the stable fuel bed characteristic of a coal fire to keep the heating plant warm and conditioned for use, to provide positive assurance that the coal burner will not continue operating if fire becomes extinguished. Unique indicator dial tells which one of four reasons is responsible for operation or idleness of burner. Available only on Iron Fireman automatic coal burners.

MADE BY—*Iron Fireman Manufacturing Co., 3170 W. 106th St., Portland, Oreg.*

## Brett-Gibbons Damper

NAME — Brett - Gibbons automatic volume damper.

PURPOSE—Supplemental dampers which are to be attached to the mixing damper blades to eliminate drafts, unbalanced air distribution, air stratification, and variable air temperatures in heating and ventilating systems.

FEATURES — The supplemental dampers maintain a balanced condition of air flow to the various spaces and air ducts due to control of air volume and velocity to each air duct during periods of preheating damper full connections to the preheating chambers. The volume of air to each space of occupancy is maintained constant with either connection of reheating and preheating chambers to the air supply duct systems. A perfect balance of the air volume is said to be maintained for the comfort of the occupied spaces during the temperature regulating periods. The application of the supplemental dampers provides an improved mixing damper performance by stabilizing the damper blade openings, thus preventing a variable and extreme blade travel throughout the operating periods of the heating ventilating system. Stabilization of damper travel is said to provide a reduction of the fuel expenditure by avoiding periodic heating and cooling for temperature regulation with connections of the duct system to reheating and preheating chambers.

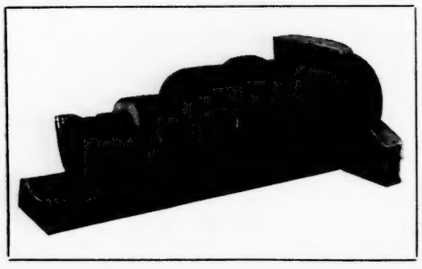
MADE BY—*Thomas J. Brett and Edward A. Gibbons, 7603 East End Ave., Chicago, Ill.*

## Adsco-Bannon Tile Conduit

NAME—Adsco-Bannon tile conduit.

PURPOSE—Conduit for underground steam and hot water lines.

FEATURES—Conduit consists of a substantial base drain tile supporting a circular salt glazed vitrified tile conduit. The tile conduit, with bell and spigot joints in approximately 2-ft. lengths, is separable on the job into two halves. The bottom half of the conduit is placed on the base drain, the joints mortared and the trench back filled to approximately the top of the half section of the conduit. Pipe rollers or multiple pipe supports with rollers are placed in recesses in the two horizontal reinforcing ribs which are in the bottom of the pipe support sections of the conduit. The pipe supports are held rigid without piercing the conduit wall. One or more pipes can be installed, tested, inspected, and insulated before the top half of the conduit is placed.



TYPES AVAILABLE—Conduit is available in various sizes to accommodate one or more pipes with or without insulation.

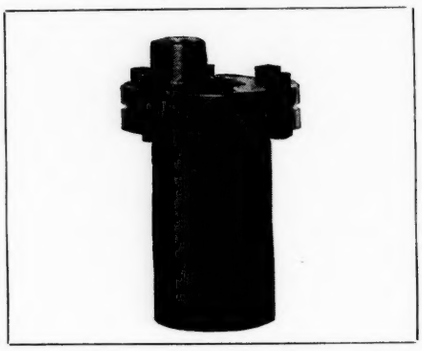
MADE BY—*American District Steam Co., North Tonawanda, N. Y.*

## Armstrong Forged Steel Trap

NAME AND MODEL NUMBER—Armstrong forged steel trap, No. 312.

PURPOSE—A small relatively low-priced trap for high-pressure drips up to 450 lb. gage.

FEATURES—The trap uses the Armstrong inverted bucket and free floating lever operating principles. There are only two moving parts, the bucket and the valve lever assembly.



The complete interior mechanism is made up of stainless steel and the valves and seats are heat treated for maximum hardness and toughness. Trap weighs approximately 30 lb. and is 10¼ in. in height and 6¾ in. in diameter.

SIZES AND CAPACITIES—Trap is provided with either ½ in. or ¾ in. screwed or flanged connections. The 450-lb. operating pressure trap has a continuous discharge capacity of approximately 2500 lb. of hot condensate per hour.

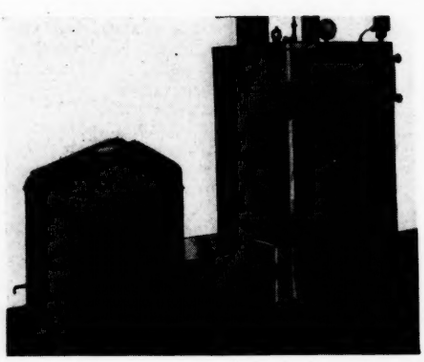
MADE BY—*Armstrong Machine Works, 746 Maple St., Three Rivers, Mich.*

## FireTender-Arco Stoker-Boiler Unit

NAME—FireTender-Arco stoker-boiler unit.

PURPOSE—For supplying steam or hot water, utilizing coal as a fuel.

FEATURES—The unit is compact and modern in design and all interior parts are concealed within a lustrous red enameled jacket. A built-in water heater furnishes hot water throughout the winter and summer. During the summer an automatic clock control feeds only enough coal to heat the water and keep the basement dry.



MADE BY—*American Radiator Co., 40 W. 40th St., New York, and Holcomb & Hoke Mfg. Co., Indianapolis, Ind.*

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**STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF MARCH 3, 1933, OF HEATING AND VENTILATING, published monthly at New York, N. Y., for October 1, 1936.**

State of New York, County of New York, ss.:

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Edgar A. Becker, who, having been duly sworn according to law, deposes and says that he is the Treasurer of The Industrial Press, publishers of HEATING & VENTILATING and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, The Industrial Press, 140-148 Lafayette St., New York, N. Y.

Editor, C. H. B. Hotchkiss, 140-148 Lafayette St., New York, N. Y.

Managing Editor, Clifford Strock, 140-148 Lafayette St., New York, N. Y.

Business Managers, Robert B. Luchars, 140-148 Lafayette St., New York, N. Y.; Edgar A. Becker, 140-148 Lafayette St., New York, N. Y.; Erik Oberg, 140-148 Lafayette St., New York, N. Y.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)

The Industrial Press, 140-148 Lafayette St., New York, N. Y.; Louis Pelletier, 140-148 Lafayette St., New York, N. Y.; Erik Oberg, 140-148 Lafayette St., New York, N. Y.; Robert B. Luchars, 140-148 Lafayette St., New York, N. Y.; Edgar A. Becker, 140-148 Lafayette St., New York, N. Y.; Laura A. Brownell, 140-148 Lafayette St., New York, N. Y.; Franklin D. Jones, 140-148 Lafayette St., New York, N. Y.; Elizabeth Y. Urban, 163 Western Drive, Longmeadow, Mass.; Helen L. Ketchum, Atlantic Ave., Cohasset, Mass.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are:

None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

EDGAR A. BECKER, Treasurer

Sworn to and subscribed before me this 22nd day of September, 1936.

CHARLES P. ABEL

Notary Public
Kings County No. 250
Kings Register No. 7079
N. Y. County No. 155
N. Y. Register No. 7-A-89
My Commission Expires
March 30, 1937.

## *for the installed cost of* Anaconda Copper Tubes *and* Fittings *is scarcely any more than that of rustable piping*

TODAY industry can have the advantages of copper piping . . . at a first cost nearly level with that of rustable material. Anaconda Copper Tubes, installed with Anaconda "Solder-Type" Fittings, offer outstanding value for countless uses where conditions of pressure and temperature are not excessive. For instance:

***Plumbing:*** Hot and cold water lines. Fire sprinkler systems.

***Heating:*** Low pressure steam lines. Hot water lines. Fuel lines.

***Refrigeration and Air Conditioning:*** Refrigerant circulation lines. Humidifying apparatus.

***Mechanical Uses:*** Pressure lubricating systems. Hydraulic pressure lines (low pressure). Circulating lines for lubricants. Low pressure steam and air lines. Pump equipment. Condensers, evaporators and heat exchangers. Other fluid-conveying lines.

***Process Uses — Pipe Lines for:*** Breweries, Distilleries and Wineries; Textile Mills, Paper Mills, Sugar Mills, Chemical Plants, etc.

The low cost of this non-rust piping is due to the fact that no threading is required for "solder" connections. Consequently both tubes and fittings may be made lighter in weight than standard pipe materials. Yet the tubes *and the joints* provide more than ample strength for the conditions listed above.

### *In 3 wall thicknesses*

Anaconda Copper Tubes are furnished in three wall thicknesses—Types "K," "L" and "M," which conform to U S. Government Specification No. WW-T-799 and A.S.T.M. Specification No. B-88-33.

### *A complete line of fittings*

The American Brass Company now furnishes a *complete* line of Anaconda Fittings for every copper tube requirement. "Solder-Type" Fittings may be had in either wrought copper or cast bronze; flared tube type fittings are cast bronze. All are furnished in elbows, tees, couplings and unions, including a complete range of reduction and adapter combinations. 3676

THE AMERICAN BRASS COMPANY

ANACONDA

General Offices: Waterbury, Connecticut

*Offices and Agencies in Principal Cities*

In Canada:

ANACONDA AMERICAN BRASS LTD., New Toronto, Ont.

# ANACONDA COPPER & BRASS

# Final Degree-Day Figures for October, 1936

**HEATING & VENTILATING continues its ninth year of publishing degree-day data for various large cities. The figures on this page are the final ones for October, 1936, while the preliminary figures for November, 1936, appear on page 70.**

| | Albany, N. Y. | Atlanta, Ga. | Baltimore, Md. | Birmingham, Ala. | Boston, Mass. | Buffalo, N. Y. | Burlington, Vt. |
|---|---|---|---|---|---|---|---|
| Degree-days for October, 1936..... | 401 | 90 | 195 | 74 | 338 | 420 | 529 |
| Degree-days, Sept. 1, '36 to Oct. 31, '36. | 511 | 90 | 223 | 74 | 460 | 542 | 746 |
| Degree-days, Sept. 1, '35 to Oct. 31, '35. | 544 | 79 | 252 | 41 | 474 | 591 | 756 |
| Degree-days, Sept. 1 to Oct. 31, Normal | 518 | 96 | 223 | 0 | 411 | 494 | 625 |

| | Cheyenne, Wyo. | Chicago, Ill. | Cincinnati, Ohio | Cleveland, Ohio | Columbus, Ohio | Denver, Colo. | Des Moines, Iowa |
|---|---|---|---|---|---|---|---|
| Degree-days for October, 1936..... | 635 | 363 | 285 | 346 | 309 | 471 | 402 |
| Degree-days, Sept. 1, '36 to Oct. 31, '36. | 851 | 426 | 334 | 423 | 362 | 619 | 464 |
| Degree-days, Sept. 1, '35 to Oct. 31, '35. | 858 | 440 | 325 | 435 | 380 | 538 | 500 |
| Degree-days, Sept. 1 to Oct. 31, Normal | 845 | 356 | 248 | 393 | 313 | 500 | 357 |

| | Detroit, Mich. | Dodge City, Kan. | Duluth, Minn. | El Paso, Tex. | Erie, Pa. | Evansville, Ind. | Fort Wayne, Ind. |
|---|---|---|---|---|---|---|---|
| Degree-days for October, 1936..... | 429 | 365 | 800 | 111 | 363 | 213 | 373 |
| Degree-days, Sept. 1, '36 to Oct. 31, '36. | 534 | 458 | 1021 | 147 | 449 | 231 | 456 |
| Degree-days, Sept. 1, '35 to Oct. 31, '35. | 569 | 350 | 1034 | 102 | 474 | 199 | 490 |
| Degree-days, Sept. 1 to Oct. 31, Normal | 442 | 276 | 881 | 40 | 411 | 155 | 347 |

| | Grand Rapids, Mich. | Harrisburg, Pa. | Hartford, Conn. | Indianapolis, Ind. | Kansas City, Mo. | La Crosse, Wis. | Lincoln, Neb. |
|---|---|---|---|---|---|---|---|
| Degree-days for October, 1936..... | 461 | 291 | 371 | 298 | 276 | 543 | 372 |
| Degree-days, Sept. 1, '36 to Oct. 31, '36. | 572 | 343 | 471 | 359 | 327 | 648 | 438 |
| Degree-days, Sept. 1, '35 to Oct. 31, '35. | 547 | 385 | 473 | 352 | 349 | 620 | 493 |
| Degree-days, Sept. 1 to Oct. 31, Normal | 476 | 329 | 392 | 298 | 214 | 558 | 316 |

| | Little Rock, Ark. | Los Angeles, Calif. | Louisville, Ky. | Madison, Wis. | Memphis, Tenn. | Milwaukee, Wis. | Minneapolis, Minn. |
|---|---|---|---|---|---|---|---|
| Degree-days for October, 1936..... | 139 | 25 | 232 | 527 | 145 | 473 | 579 |
| Degree-days, Sept. 1, '36 to Oct. 31, '36. | 142 | 25 | 257 | 638 | 146 | 562 | 671 |
| Degree-days, Sept. 1, '35 to Oct. 31, '35. | 121 | 30 | 225 | 583 | 118 | 516 | 662 |
| Degree-days, Sept. 1 to Oct. 31, Normal | 47 | 0 | 186 | 546 | 62 | 534 | 574 |

| | Nashville, Tenn. | New Haven, Conn. | New Orleans, La. | New York, N. Y. | Norfolk, Va. | Oklahoma City, Okla. | Omaha, Neb. |
|---|---|---|---|---|---|---|---|
| Degree-days for October, 1936..... | 166 | 343 | 12 | 261 | 91 | 230 | 403 |
| Degree-days, Sept. 1, '36 to Oct. 31, '36. | 167 | 422 | 12 | 307 | 95 | 277 | 469 |
| Degree-days, Sept. 1, '35 to Oct. 31, '35. | 157 | 435 | 4 | 322 | 143 | 191 | 525 |
| Degree-days, Sept. 1 to Oct. 31, Normal | 136 | 399 | 0 | 276 | 99 | 105 | 329 |

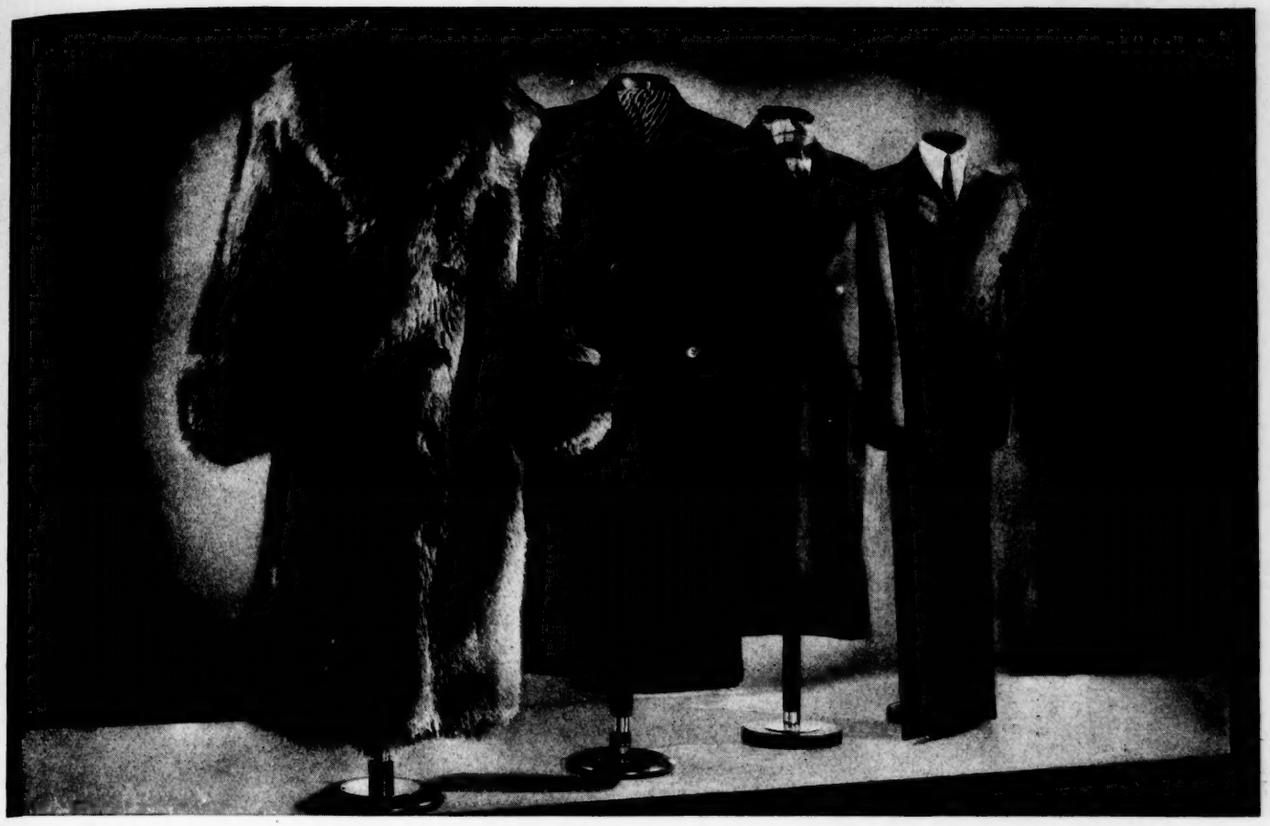
| | Peoria, Ill. | Philadelphia, Pa. | Pittsburgh, Pa. | Portland, Me. | Portland, Oreg. | Providence, R. I. | Reading, Pa. |
|---|---|---|---|---|---|---|---|
| Degree-days for October, 1936..... | 350 | 221 | 293 | 452 | 215 | 346 | 278 |
| Degree-days, Sept. 1, '36 to Oct. 31, '36. | 408 | 258 | 341 | 639 | 296 | 453 | 337 |
| Degree-days, Sept. 1, '35 to Oct. 31, '35. | 440 | 274 | 368 | 652 | 395 | 462 | 361 |
| Degree-days, Sept. 1 to Oct. 31, Normal | 384 | 242 | 313 | 563 | 437 | 410 | 344 |

| | Richmond, Va. | Rochester, N. Y. | St. Louis, Mo. | Salt Lake City, Utah | San Francisco Calif. | Scranton, Pa. | Seattle, Wash. |
|---|---|---|---|---|---|---|---|
| Degree-days for October, 1936..... | 157 | 402 | 233 | 329 | 111 | 390 | 280 |
| Degree-days, Sept. 1, '36 to Oct. 31, '36. | 170 | 508 | 264 | 434 | 215 | 480 | 445 |
| Degree-days, Sept. 1, '35 to Oct. 31, '35. | 216 | 563 | 275 | 422 | 293 | 537 | 513 |
| Degree-days, Sept. 1 to Oct. 31, Normal | 158 | 503 | 205 | 406 | 260 | 457 | 595 |

| | Spokane, Wash. | Syracuse, N. Y. | Toledo, Ohio | Trenton, N. J. | Utica, N. Y. | Washington, D. C. | Wichita, Kan. |
|---|---|---|---|---|---|---|---|
| Degree-days for October, 1936..... | 401 | 386 | 381 | 282 | 420 | 202 | 288 |
| Degree-days, Sept. 1, '36 to Oct. 31, '36. | 586 | 506 | 466 | 334 | 546 | 228 | 347 |
| Degree-days, Sept. 1, '35 to Oct. 31, '35. | 658 | 573 | 495 | 368 | 663 | 268 | 319 |
| Degree-days, Sept. 1 to Oct. 31, Normal | 707 | 521 | 378 | 242 | 612 | 251 | 192 |

**To obtain unit fuel consumption figures for any city shown above, multiply the number of degree-days by the following factors: for coal, 0.006; for oil, 0.00069; for gas, 0.096. Figures obtained will show coal consumption in pounds per square foot of radiator surface; oil consumption in gallons per square foot; gas consumption in cubic feet per square foot—all for the period covered by the number of degree-days. The figures assume the use of steam radiators emitting 240 B.t.u. per sq. ft. per hr., a system operation at 100% efficiency, and radiators calculated for maintaining 70° in zero weather. Heating values assumed for the fuels are 12,000 B.t.u. per lb. for coal; 140,000 B.t.u. per gal. for oil, and 1,000 B.t.u. per cu. ft. for gas. To correct for other heating values, efficiency and design conditions, follow the method explained in the "HEATING & VENTILATING Degree-day Handbook" or on H. & V.'s Reference Data Sheet Nos. 67 and 68. Degree-days as given above for a "normal" month or season are based on averages for a long period of years, ending about 1922. Averages covering different periods will disagree with the above figures slightly.**

## . . . . . AS ONE'S WARDROBE
# MEETS *Any* TEMPERATURE CHANGE



## *So* DUNHAM DIFFERENTIAL HEATING
### *meets the Temperature Changes of Heating Weather*

because it makes the Heat Supply continuously balance the Heat Demand. This ability of Sub-atmospheric Steam is far beyond that of ordinary systems that must have pressure, however slight, to effect circulation.

**Differential Heating** not only meets sub-zero weather with required temperatures of steam-under-pressure, but automatically circulates equally well, steam at any of the bland temperatures of the Steam Table down to 133 degrees.

Radiator heat output may be further reduced by automatically-accomplished partial radiator filling. Such an acute adaptability to varying heat requirements naturally eliminates wasteful overheating.

**Differential Heating** reflects its values in health and efficiency to those within its influence. In addition it offers a reduced heating budget beyond the ability of an uncontrolled system.

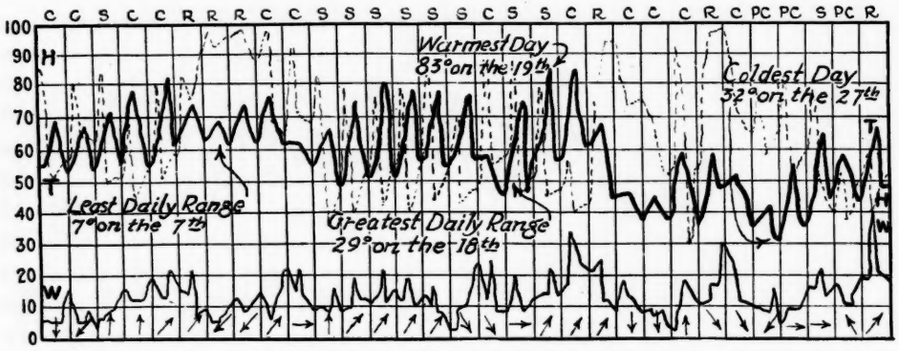
DUNHAM Differential HEATING

*"If the Steam Table is right 'Differential' is right"*

C. A. DUNHAM COMPANY 450 E. OHIO ST. CHICAGO

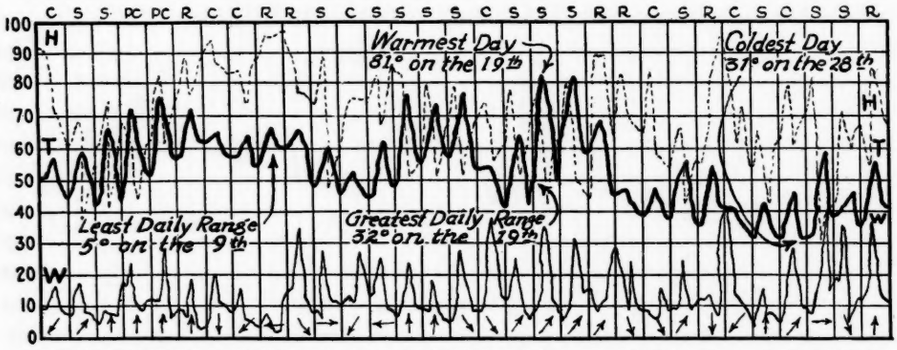
# THE WEATHER FOR OCTOBER, 1936

Plotted from records compiled for HEATING & VENTILATING by the U. S. Weather Bureau. Heavy curves (T), dry bulb temperatures in deg. F.; dotted lines (H), per cent relative humidity from readings at 8 a.m., noon, and 8 p.m. Light lines (W), wind velocity in m.p.h. Arrows indicate prevailing wind directions, north being arrow pointing up, etc.; S—clear; PC—partly cloudy; C—cloudy; R—rain; Sn—snow.



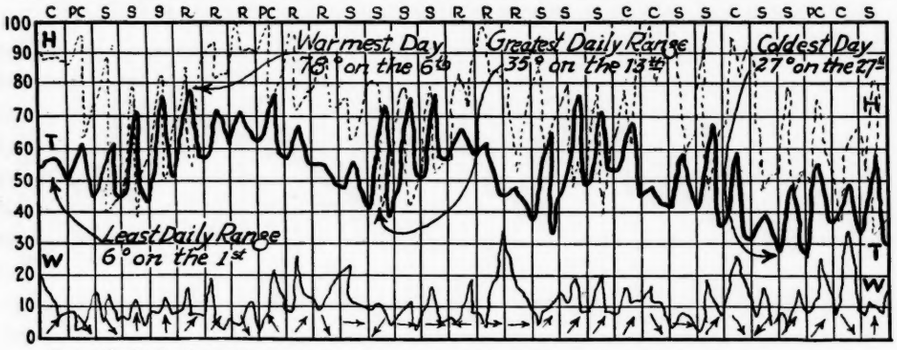

## St. Louis

Mean temp. for month, 58.8F; aver. wind velocity, 11.9 m.p.h.; prevailing direction of wind, SW.



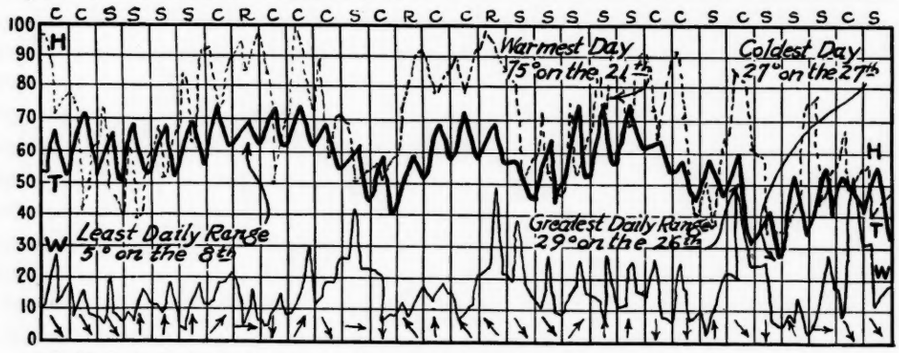

## Chicago

Mean temp. for month, 53.6F; aver. wind velocity, 10.3 m.p.h.; prevailing direction of wind, S.



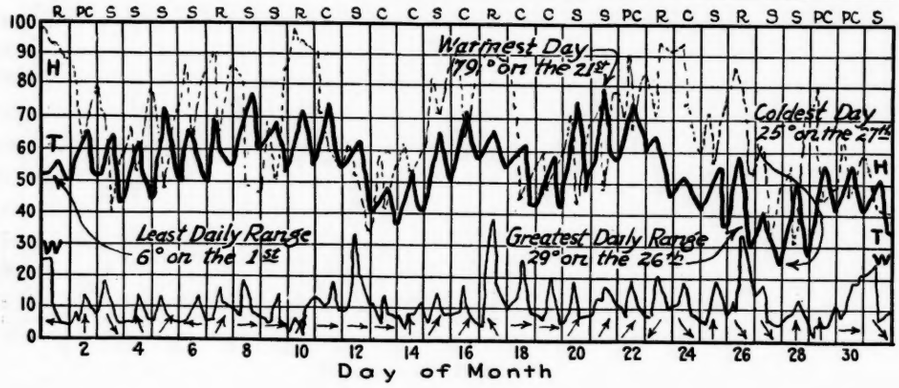

## Pittsburgh

Mean temp. for month, 54.4F; aver. wind velocity, 10 m.p.h.; prevailing direction of wind, SW.




## New York

Mean temp. for month, 57.0F; aver. wind velocity, 14.3 m.p.h.; prevailing direction of wind, SW.



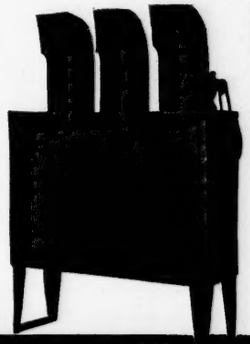

## Boston

Mean temp. for month, 54.4F; aver. wind velocity, 10 m.p.h.; prevailing direction of wind, SW.

Suspension type units are available in 24 Models with capacities from 18,000 B.t.u. to 658,000 B.t.u. per hour.

# YOUNG UNIT HEATERS

There are ten floor Models varying from 120,000 to 800,000 B.t.u. capacities

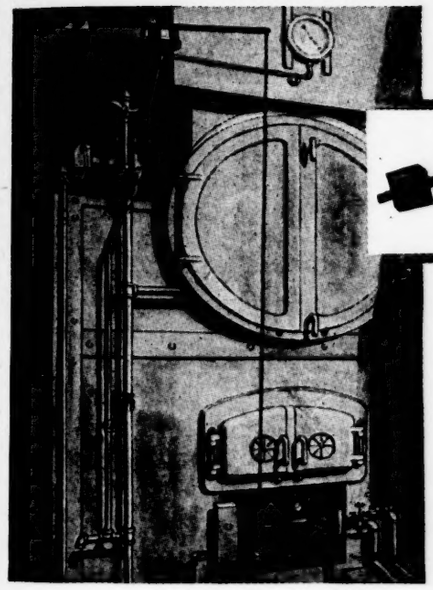


Offer the ideal type of heat for factories, warehouses, etc., as well as lower heating costs. From the complete catalog line of Young units you can select a unit to meet your exacting requirements.

OFFICES IN ALL PRINCIPAL CITIES

YOUNG RADIATOR COMPANY
RACINE, WISCONSIN

Young Quality



METAPHRAM
Type C2

for low pressure or vacuum systems — oil or coal fired.

METAPHRAM

## METAPHRAM Gradual Control

covers the entire range of domestic hot water and low pressure boilers and tank heaters, either gas, oil or coal fired.

Full stock carried in New York, 210 E. 45th St.

Descriptive Bulletins on Request

**NATIONAL REGULATOR CO.**
2309 KNOX AVENUE CHICAGO

# new!

Here is an automatic mixing valve for hot and cold water that meets all the requirements of industry.

Wherever water is required at different temperatures — for showers, wash rooms, cleaning, or process work — this simple, compact and self-contained unit will do the job of mixing automatically, without supervision.

## SARCO Water Blender

has the following valuable features:

1. Can be furnished for any temperature between 30° and 250° F.
2. Adjustable in the field a total of 50° F.
3. The valve has double seats for both hot and cold water. It is, therefore, fully balanced. Differing or fluctuating pressures will not disturb the operation. No reducing valves are required.
4. Furnished in all brass construction for installations where appearance is important—nickel or chromium plated if desired. Also made in iron body with bronze trim.
5. Available in sizes ¾" to 4" for pressures up to 150 lbs.

The Sarco Blender is used also as an automatic by-pass valve for the control of temperatures of cooling water or brine in connection with unit coolers, brine coils, engine jackets and similar applications.

For full information write for Bulletin P-140.

**SARCO COMPANY, Inc.**
183 Madison Ave., New York, N. Y.

*Branches in Principal Cities*
Sarco Canada Limited, Federal Bldg., Toronto, Ont., Canada

Protect Your Pipe with SARCO PIPE SAVERS

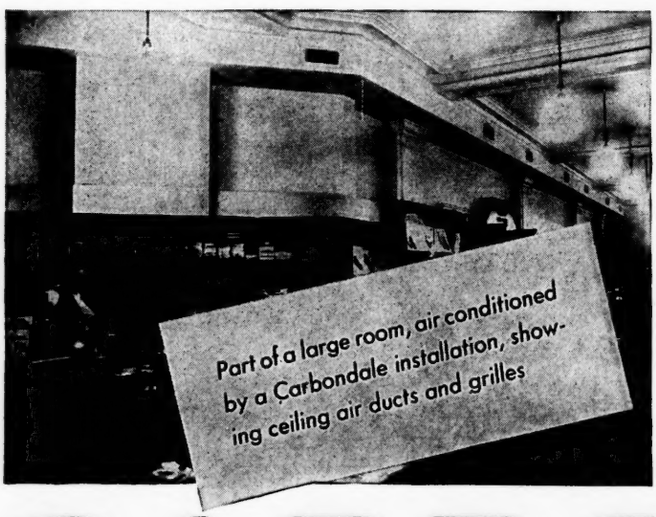
# Preliminary Degree-Day Figures for November, 1936

The table below gives degree-day figures for November for 48 important cities. As HEATING & VENTILATING goes to press somewhat earlier this month than usual, the following figures do not cover the complete month of November. Totals are for the first 27 days of the month only. Final figures for October, 1936 appear on page 66.

| | | | |
|---|---|---|---|
| Albany, N. Y. | 718 | Little Rock, Ark. | 420 |
| Atlanta, Ga. | 367 | Los Angeles, Calif. | 17 |
| Baltimore, Md. | 480 | Memphis, Tenn. | 442 |
| Birmingham, Ala. | 353 | Milwaukee, Wis. | 759 |
| Boston, Mass. | 619 | Minneapolis, Minn. | 891 |
| Buffalo, N. Y. | 751 | Nashville, Tenn. | 493 |
| Cheyenne, Wyo. | 762 | New Haven, Conn. | 601 |
| Chicago, Ill. | 711 | New Orleans, La. | 149 |
| Cincinnati, Ohio | 643 | New York, N. Y. | 559 |
| Cleveland, Ohio | 663 | Oklahoma City, Okla. | 452 |
| Columbus, Ohio | 677 | Omaha, Neb. | 701 |
| Denver, Colo. | 600 | Philadelphia, Pa. | 532 |
| Des Moines, Iowa | 734 | Pittsburgh, Pa. | 683 |
| Detroit, Mich. | 747 | Portland, Me. | 698 |
| Dodge City, Kan. | 563 | Portland, Oreg. | 870 |
| Duluth, Minn. | 1040 | Richmond, Va. | 423 |
| El Paso, Tex. | 378 | St. Louis, Mo. | 577 |
| Erie, Pa. | 685 | Salt Lake City, Utah | 736 |
| Evansville, Ind. | 566 | San Francisco, Calif. | 166 |
| Fort Wayne, Ind. | 719 | Scranton, Pa. | 690 |
| Grand Rapids, Mich. | 743 | Seattle, Wash. | 464 |
| Harrisburg, Pa. | 618 | Spokane, Wash. | 830 |
| Indianapolis, Ind. | 660 | Washington, D. C. | 496 |
| Kansas City, Mo. | 570 | Wichita, Kan. | 512 |


Get ready for 1937

AIR CONDITIONING



Part of a large room, air conditioned by a Carbondale installation, showing ceiling air ducts and grilles

Now is the time to prepare for 1937 air conditioning requirements in...

| | | |
|---|---|---|
| Stores | Restaurants | Banks |
| Hotels | Public Buildings | Apartments |
| Theatres | | Homes |
| Hospitals | Offices | Factories |

Carbondale specialists, with their exceptionally broad background of experience, stand ready to discuss your needs, advise and estimate costs, without obligation.

CARBONDALE

CARBONDALE MACHINE CORPORATION
UNIT OF WORTHINGTON PUMP AND MACHINERY CORPORATION
General Offices: HARRISON, NEW JERSEY

ATLANTA BOSTON BUFFALO CHICAGO CINCINNATI CLEVELAND DALLAS DENVER DETROIT EL PASO HOUSTON KANSAS CITY LOS ANGELES NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH ST. LOUIS ST. PAUL SAN FRANCISCO SEATTLE TULSA WASHINGTON

AR-3658

# WITH THE MANUFACTURERS

**The Louis Allis Co.**, Milwaukee, Wis., has appointed **C. J. Fechheimer** to its engineering staff in the capacity of consulting engineer. Mr. Fechheimer, associated with the electrical manufacturing industry for over twenty years, has been engaged for the past five years as a private consultant, and more recently was appointed director of the college at the Milwaukee School of Engineering.

**Auditorium Conditioning Corp.**, New York, announces that **Buffalo Forge Co.**, Buffalo, N. Y., manufacturer of fans, blowers, and air conditioning equipment, has been licensed under the Auditorium patents.

**Auditorium Conditioning Corp.**, New York, announces that **Frick Co.**, Waynesboro, Pa., manufacturer of air conditioning equipment, has been licensed under the Auditorium patents.

**The Babcock & Wilcox Tube Co.**, Beaver Falls, Pa., has appointed **H. S. Dershimer** as Tulsa, Okla., district sales manager with offices in the Philtower Building and direct representation in Houston and Dallas, Tex. Dallas headquarters will be at 728 Wilson Building and business from that area will be handled by **Reid R. Lumsden. O. E. Berg** will be in charge of the Houston office at 1007 Electric Building.

**Baker Ice Machine Co., Inc.**, Omaha, Neb., reports that **J. Neal Clemmer** flew from Omaha to Manila, P. I., on the China Clipper late in November for a three months' air conditioning sales promotion program and research work in the field of air conditioning in the tropics.

**A. M. Byers Co.**, Pittsburgh, Pa., through its vice-president in charge of sales, **M. J. Czarniecki**, announces the following appointments effective November 2: **George B. Cushing** will be manager of sales promotion. Mr. Cushing came with A. M. Byers Co. in 1928 to organize and head the present advertising department, and subsequently in 1931 organized a technical promotion group known as the engineering service department; **B. D. Landes**, who has been in the technical group since its inception, has been appointed manager of the engineering service department; **T. C. Winans**, who has been in the advertising department since 1930, has been appointed advertising manager. Both the manager of the engineering service department and the advertising manager become a part of the newly formed sales promotion group headed by Mr. Cushing.

**R. H. Gardner**, formerly of the Washington office of the company, has been appointed manager of pipe sales and will take over all sales management duties in connection with wrought iron and steel tubular products.

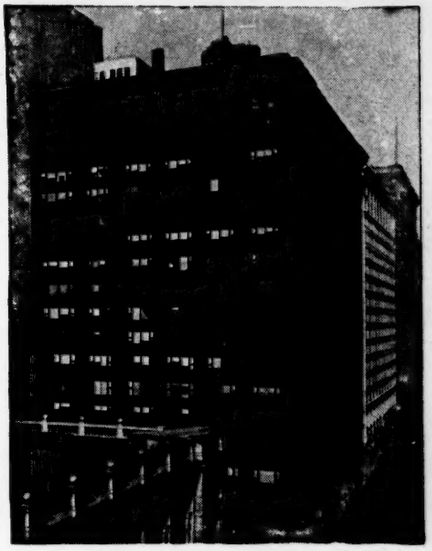
**Carrier Corp.**, Newark, N. J., announces the appointment of **William Hull Stangle** as a member of its architectural service. Mr. Stangle will cooperate with architects and building owners.

**Crane Co.**, Chicago, Ill., has appointed **F. C. Allen** manager of its showrooms at 23 W. 44th St., New York.

Mr. Allen was associated with the Trenton Potteries Co. for many years. In 1928 he became manager of the company's New York office. In 1934 he joined Crane Co. as a special factory representative. This position he held until his recent appointment.

**Electric Furnace-Man, Inc.**, New York, announces that **Harry Campbell**, who has been in charge of the school for service men in the factory, has been transferred to the field staff, succeeding Harold S. Maxson who has joined the staff of Anthracite Industries, Inc., to take charge of that organization's Springfield, Mass., office. The company has also added **Robert Barrett** to its staff. Mr. Barrett formerly represented the Lehigh Coal & Navigation Co. in New Hampshire, Vermont, and Maine.

*(Concluded on page 72)*

Marquette Building, Chicago, Ill.

## REDUCE HEATING COST $6,931.92 IN TWO YEARS

### 16-Story Chicago Building Uses Webster Moderator System to Slash Steam Consumption

### CUTS COST OF INSTALLATION

Chicago, Ill.—The cost of heating Chicago's 16-story Marquette Building was reduced $6,931.92 in two heating seasons as a result of application of a Webster one-pipe Moderator System in the fall of 1934.

The Webster Moderator System was originally designed for two-pipe steam heating systems, but by incorporating certain modifications in the control it was possible to avoid the cost of installing separate return piping and at the same time produce results reasonably comparable with those obtained by controlled two-pipe systems.

During 1934-35, steam consumption was reduced 3,139,000 lbs., the equivalent of $2,594.29. Steam savings for 1935-36 were 4,846,000 lbs., a cash reduction of $4,337.63.

In addition to reducing heating costs, the Webster Moderator System regulates steam circulation in the Marquette Building so that the entire building heats evenly and rapidly. The Marquette Building has 46,930 sq. ft. of installed direct radiation. William Lees, Inc., of Chicago, acted as modernization heating contractors.

The method of computing the steam savings was developed by Mr. Earl Shultz, Vice-President of the Illinois Maintenance Company and agent of the Marquette Building. Mr. Shultz' method of measuring the savings served as a basis for an article, "Determination of Heat Saving" in SKYSCRAPER MANAGEMENT, a leading building management publication. A few reprints of this article are available for interested building owners and managers.

PROOF that *One-Pipe* installations can be *orificed* and effectively controlled with the Webster Moderator System is afforded by the operating record of the Marquette Building.

A Webster Heating Modernization Program offers building owners and managers an opportunity to protect their property investment, keep tenants well satisfied and make a substantial reduction in heating expense.

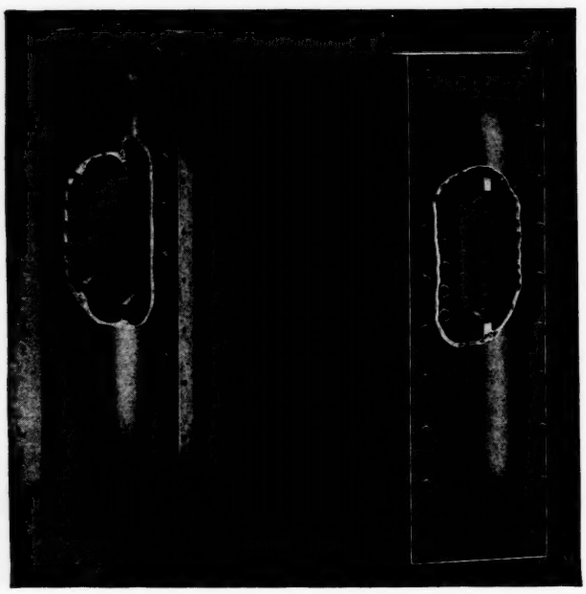
Webster Systems have been installed in 70,000 buildings — new buildings as well as old.

If you are interested in heating *new* buildings, or in improved heating service and lower heating cost in your present building, address

Warren Webster & Company . . . Camden, N. J.
Pioneers of the Vacuum System of Steam Heating
*Branches in 60 principal U. S. Cities . . . Darling Bros., Ltd., Montreal, Canada*

# NOW
# CLEANABLE TUBE
# AEROFIN

## With Removable Headers Simplifies Cleaning of Tube Interior



*LEFT: Water connection end of unit showing baffles for 18-tube single pass. For 36 tubes double pass, center baffles only used. RIGHT: Rear end for 18-tube single pass. For 36 tubes double pass, baffle omitted.*

**Aerofin Cleanable Tube units, for heating and cooling with water, have been designed for use where the prevalence of sediment or scale-forming chemicals in the water, makes periodic cleaning necessary.**

**Now, by the simple removal of a few bolts, both end headers may be disengaged, exposing the ends of all tubes.**

**Headers are designed so that water may be circulated in single or double passes (18 or 36 tubes in parallel) making possible the use of large quantities of water with small head loss. Send for descriptive folder.**

AEROFIN is sold only by Manufacturers of Nationally Advertised Fan System Apparatus.

AEROFIN CORPORATION
850 Frelinghuysen Avenue
Newark NJ
Chicago Detroit New York Philadelphia


*(Concluded from page 71)*

**The Emerson Electric Mfg. Co., Inc.**, St. Louis, Mo., announces the appointment of **Irving L. Kordenbrock** to its fan sales staff. Mr. Kordenbrock was formerly associated with the Famous-Barr Co., St. Louis, department store, as manager of its electrical appliance department.

**Fairbanks, Morse & Co.**, Chicago, Ill., announces the appointment of the **Dade Refrigerating Co., Inc.**, Miami, Fla., as Ortho-Clime distributor for southern Florida.

**The Ohio Electric Mfg. Co.**, Cleveland, Ohio, announces the appointment of **H. W. Schmid**, 1955 Ruckle St., Indianapolis, Ind., as its representative in Indianapolis territory.

**Young Radiator Co.**, Racine, Wis., has appointed **W. J. Sommers**, 505 Delaware Ave., Buffalo, N. Y., salesman in the Buffalo territory.

## NEW CATALOGS

*Alco Valve Co., Inc.*, 2628 Big Bend Blvd., St. Louis, Mo. A number of data sheets on Alco valves as well as a price list on refrigeration control valves. The data sheets cover the following equipment: magnetic stop valves for liquid and suction line applications; liquid and suction line filters for ammonia, methyl chloride and Freon; parts list and instructions for the replacement of valve pins and seats in the Alco type KR Junior thermo valves.

*The American Foundry Equipment Co.*, 555 Byrkit St., Mishawaka, Ind., has issued a new 24-page data book, No. 22, entitled "American Dustube Dust Control." The first half of this book is devoted to description, illustration, and drawings of the American Dustube dust collector, and describes in detail its application to dust control problems. The last half of the book is devoted to engineering data and includes among others the following: specifications for exhaust piping; care of dust control systems; static pressure readings and how to take them; and air volumes in pipe lines at various velocities.

*American Radiator Co.*, 40 West 40 St., New York, has published five circulars on Ideal Arco accessories. These circulars cover the following subjects: heaters for domestic hot water; air, vacuum and vent valves; regulators and controls for steam, water and vapor; products of H. A. Thrush & Co., and McDonnell & Miller, and radiator valves.

*Binks Manufacturing Co.*, 3114-40 Carroll Ave., Chicago, has published a standard-size, loose-leaf folder, W.H.750, on its cooling tower equipment available for use with Westinghouse CLS condensing units. Bulletin contains illustrations and data on three types of Binks cooling towers.

*The Brown Instrument Co.*, Philadelphia, Pa., has just published a new catalog on Brown Thermometers and Pressure Gauges. This new catalog, No. 6703, covers the complete line of Brown thermometers and pressure gauges—indicating, recording, and controlling—and enumerates the wide range of industries to which they are applicable. It describes the classes of Brown thermometers and pressure gauges, explains their outstanding constructional features in simple, non-technical language, and presents a detailed description of each instrument of the line.

*The Brown Instrument Co.*, Philadelphia, Pa. A standard-size catalog, No. 8901, on the Brown air operated controller for the control of temperature, pressure, flow, and liquid level; 32 pages.

*Buffalo Forge Co.*, Buffalo, N. Y., has published a standard-size, 4-page bulletin, No. 3025, on Buffalo (type ECC) evaporative condensers. Included in this bulletin are a list of the specifications. the ratings and the dimensions of this line of evaporative condensers.

*Elgin Softener Corp.*, Elgin, Ill., has published a 16-page, standard-size bulletin entitled "The Inside Story of Boiler Water Conditioning." This bulletin is written in a non-technical manner for industrial executives, engineers, and plant operators. It discusses the various methods of treating boiler water.

*McDonnell & Miller*, Wrigley Bldg., Chicago. A standard-size, loose-leaf catalog describing their line of float-operated valves and switches. Includes illustrated information on the method of installing the various types of equipment offered by this company.

*Mills Novelty Co.*, Chicago, has published an instructive and attractive book entitled "Why We Are in the Compressor Business." This book has a cloth cover, is 6½ x 8 in. in size, and has approximately 35 pages. The book discusses the reason for the Mills Company entering the compressor business, lists the size and types of compressors manufactured by this company, and gives some of the main features of its line of compressors. A large number of excellent photographs are used to illustrate the text.

*National Radiator Corp.*, Johnstown, Pa., has published a standard-size, 36-page booklet on the Aero Convector. Some of the subjects discussed in this bulletin are selecting the right convector, the complete line of air convectors, piping connections, dimensions, instruction details, and performance data.

*Republic Steel Corp.*, Cleveland, Ohio, has published a series of five booklets on Enduro Stainless Steel. The first booklet is of general nature and lists the more important applications of Enduro. Included in this booklet is a chart listing the analyses and detailed properties of 13 of the principal types of Enduro, contrasted with the properties of a common carbon steel. The second book features detailed data on Enduro 18-8, while the third is devoted to the straight-chromium types of Enduro AA,S, S-1, and FC. The fourth booklet contains information on the heat-resisting types of Enduro, and the fifth booklet treats Enduro 4-6% chromium steels.

*Schwitzer-Cummins Co.*, Indianapolis, Ind., has published a 16-page booklet on its line of Hy-Duty blowers and blower wheels. The principal features of its line are discussed in the opening pages of this bulletin. A special 12-page blue section is included on blower performance data and specification drawing for four types of mountings of Schwitzer-Cummins blowers.

*Worthington Pump and Machinery Corp.*, Harrison, N. J. A four-page bulletin, W-318-B5A, describing the two-stage volute centrifugal pump and motor. Presents information on sizes and capacities as well as some of the more important features.

## COMING EVENTS

DECEMBER 10-11, 1936. 12TH ANNUAL CONFERENCE ON WELDING, *Purdue University, Lafayette, Ind.*

DECEMBER 15-17, 1936. WINTER MEETING OF THE NATIONAL WARM AIR HEATING AND AIR CONDITIONING ASSOCIATION, *Stevens Hotel, Chicago, Ill.*

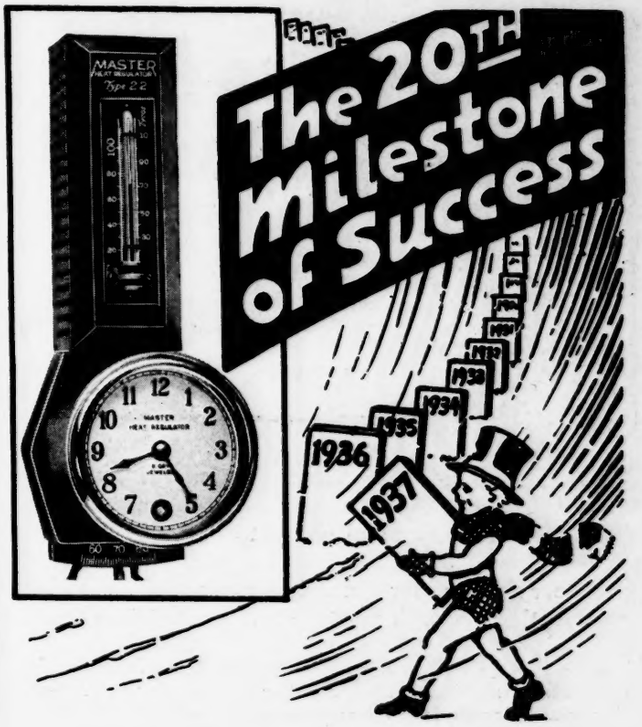
JANUARY 25-27, 1937. 43RD ANNUAL MEETING OF THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, *St. Louis, Mo.*

MARCH 15-19, 1937. NATIONAL OIL BURNER AND AIR CONDITIONING EXPOSITION, *Municipal Auditorium, Philadelphia. Sponsored by the Oil Burner Institute, New York.*

MAY 24-27, 1936. 55TH ANNUAL CONVENTION OF THE NATIONAL ASSOCIATION OF MASTER PLUMBERS, *Atlantic City, N. J. Convention headquarters at the Ambassador Hotel. Exposition to be held in the Atlantic City Auditorium.*

MAY 25-27, 1936. 4TH SHORT COURSE IN COAL UTILIZATION, *University of Illinois, Urbana, Ill.*

JUNE 1937. 31ST ANNUAL CONVENTION OF THE SMOKE PREVENTION ASSOCIATION, INC., *New York.*

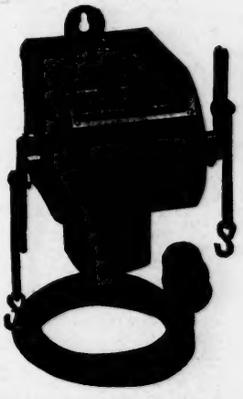

THE original Master Heat Regulator was made almost twenty-one years ago. Naturally, improvements have been made since then and its appearance has been changed. But no changes have ever taken place in its dependable service—its accuracy—its long life. Year after year its high quality has been maintained. And that is the reason for its prestige.

**Reliability Recognized by Experts**

Architects, contractors, dealers and users are enthusiastic over its dependable performance.

**Type B-22**

A low cost model that is ideal for the small home. So ruggedly is it constructed that it will actually outlast the heating plant. Listed as standard by Underwriters' Laboratories.



Dealers' Cost **$13.50**

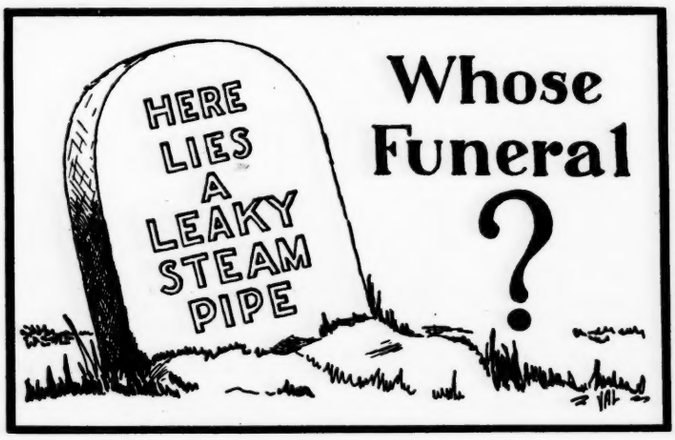
*Write for Full Information*

**WHITE MANUFACTURING COMPANY**

2364 University Ave., St. Paul, Minn.

Makers of the famous Type B-144, the Original Gradual Control Heat Regulator.

**MASTER HEAT REGULATOR**

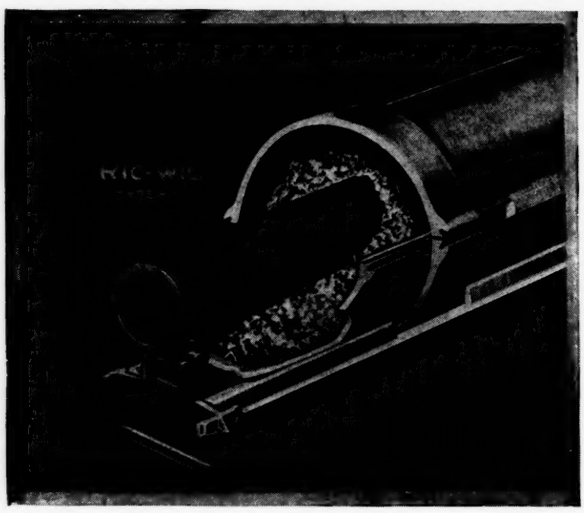



BURIED alive—that's **steam in underground lines.** Out of sight, out of mind—but it's **live** steam and it's always struggling to get out. If it does get out, whose funeral is it? Yours! Steam loss is recognized as one of the major items in power plant operating and heating costs. It must be faced, not forgotten.

The best method of facing and defeating it, as far as underground transmission is concerned, is protection with Ric-wiL Conduit. Ric-wiL Systems are correctly engineered, insulated and drained—to keep steam lines over 90% efficient. Different types in either tile or cast iron to meet all conceivable conditions. Choice of insulations, including the famous Ric-wiL Watertight Asbestos Dry-paC. Complete Ric-wiL service is available from coast to coast—engineering, installation, field supervision. Write for complete catalog, with Dry-paC sample for testing.

**The RIC-WIL Co., Union Trust Bldg., Cleveland, Ohio**
**New York** **San Francisco** **Chicago**
*Agents in principal cities*

Prominent engineering authorities claim: "A permanently dry trench is more than half of any underground job—for efficiency."

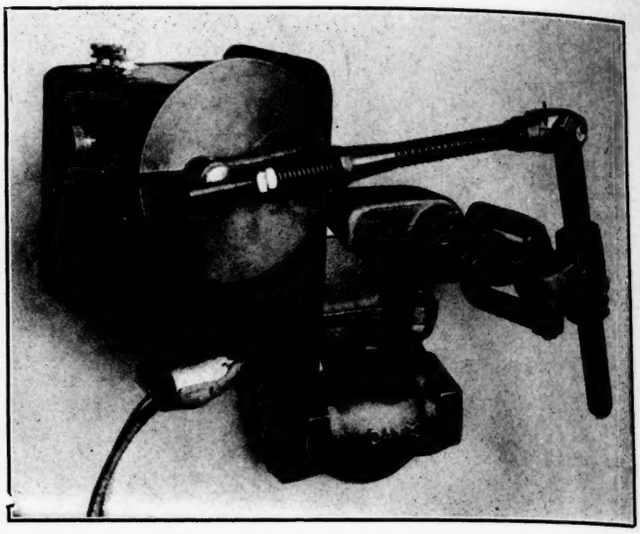


REGISTERED IN U. S. PATENT OFFICE

**RIC-WIL**

**CONDUIT SYSTEMS FOR UNDERGROUND STEAM PIPES**

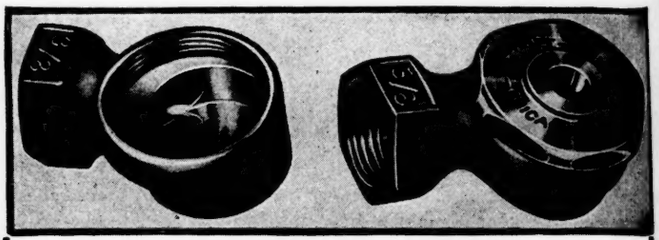
# Motorized Valves



BECAUSE Davis has long specialized in automatic valves for every type of service, the problem of giving you exactly what you want in motor operated valves is merely a matter of knowing your requirements. We have them for any kind of zone control steam heating system as well as for other electrically operated flow control hook-ups. Tell us your problem — we'll give you the answer.

## DAVIS REGULATOR CO.

2553 Washtenaw Avenue CHICAGO, ILL.



## AIR WASHING NOZZLES

ROTOJET Nozzles furnished in sizes from ¼" to 2½" pipe connections. Nozzle with cap removed shows involute whirl chamber. Binks ROTOJET Clog-Proof Spray Nozzles are the first choice of engineers everywhere for more efficient AIR WASHING. Send for Bulletin 50 today.

**BINKS MANUFACTURING CO., 3106 Carroll Ave., Chicago**
WINDSOR, ONTARIO, CANADA.

## "ALNOR" VELOMETER

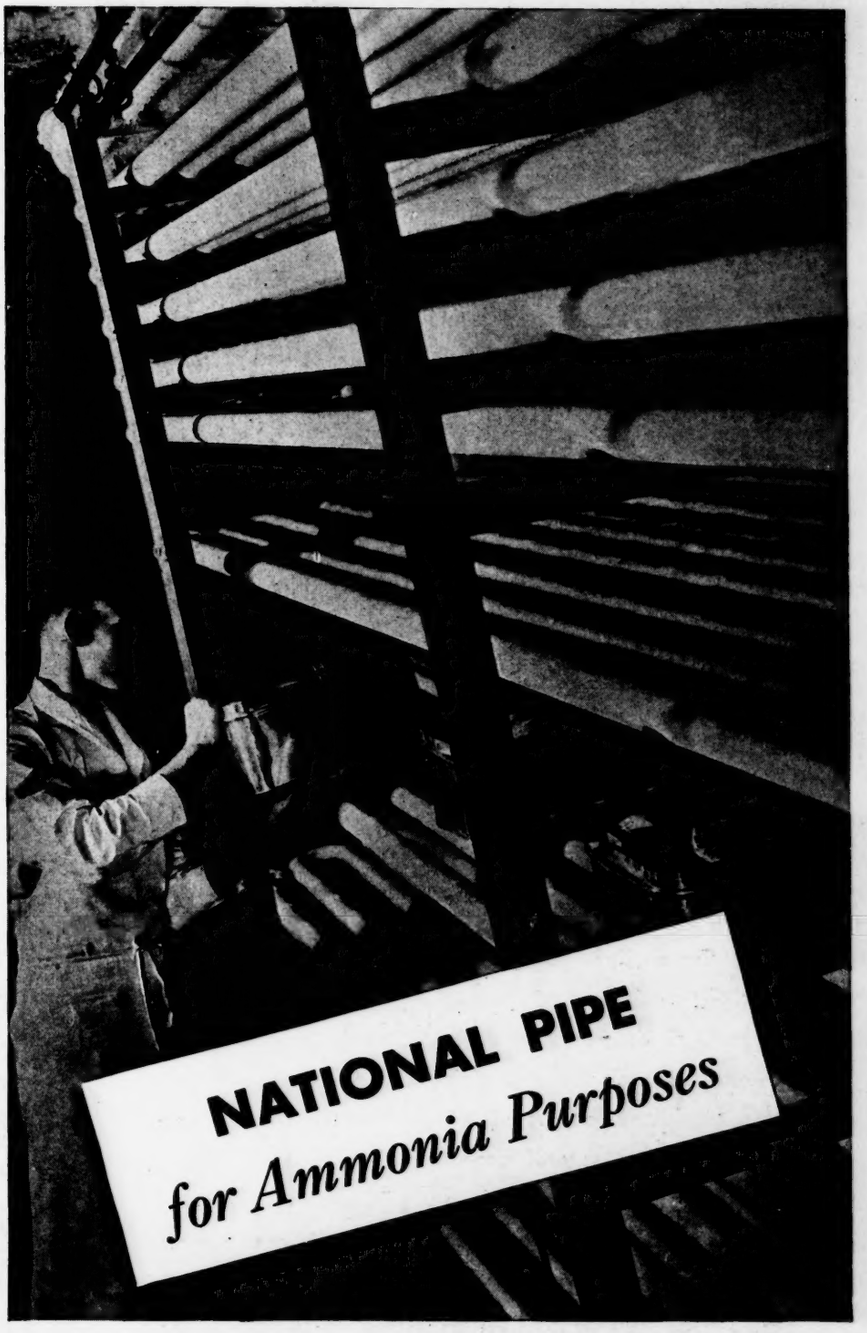
(BOYLE SYSTEM)

Instantaneous, Direct Reading Air Velocity Meter, 20 FPM to 6000 FPM

WRITE FOR FOLDER

**ILLINOIS TESTING LABORATORIES, INC.**
143 W. Hubbard St.
Chicago, Ill.

# COLD FACTS . . . *about Dependability and Ease of Fabrication*




NATIONAL Pipe for Ammonia Purposes is specifically made for this service where dependability is the first consideration.

Whether in crowded stores or lonely warehouses, any failure in the ammonia system may mean lost sales, spoiled goods, bad publicity.

Two special processes* are added to the manufacture of NATIONAL Pipe for Ammonia Purposes to make it thoroughly dependable. The first, Spellerizing—in which the hot bloom is worked and re-worked to eliminate irregularities and make a sound, uniformly dense metal. Second, the Scale Free Process—which removes the mill scale from both the inside and outside surface, thereby reducing the pitting form of corrosion.

To make dependability doubly sure, each length of pipe for this purpose is tested at pressures far above requirements of standard specifications. In addition, both crop ends of every length are crushed to make certain the weld is sound.

Workability is important too—it means easier, more economical fabrication. NATIONAL Pipe is highly ductile, easy to bend and coil . . . thereby permitting better, less costly installations. To be sure of the utmost in dependability and ease of fabrication, always specify it.

**The properties and manufacture of NATIONAL Pipe for Ammonia Purposes are described in an interesting booklet . . . gladly sent on request.*

## NATIONAL TUBE COMPANY

PITTSBURGH, PA.

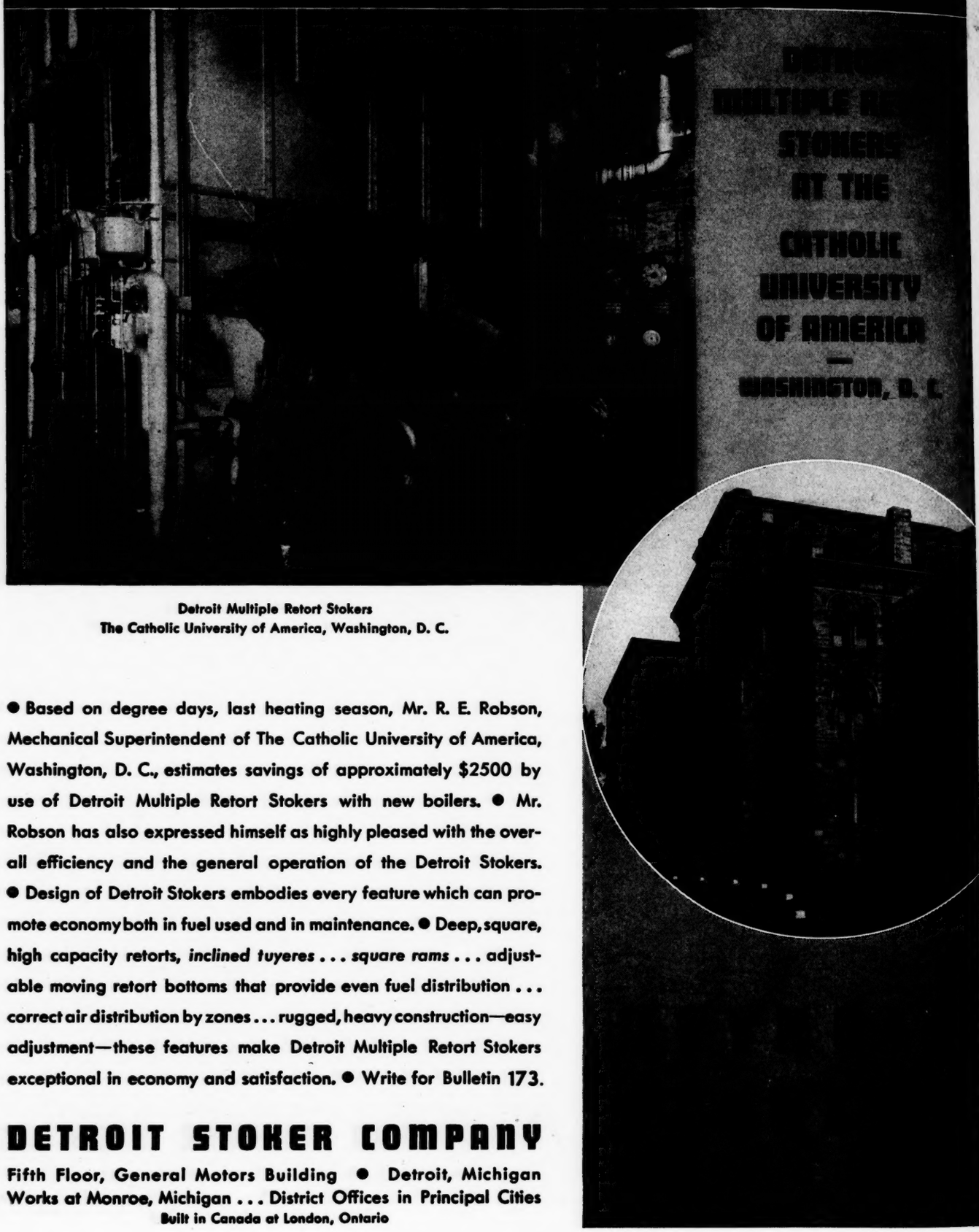
Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL



HEATING & VENTILATING, *formerly* HEATING & VENTILATING MAGAZINE, published monthly by THE INDUSTRIAL PRESS, 148 Lafayette Street, New York, N. Y. Subscription rates: United States, $2.00; Canada, $2.50; Foreign, $3.00. Single copies, 30 cents. Vol. 33, No. 12; December, 1936. Entered as second-class matter, April 18, 1925, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

# Estimated Savings of $2500




Detroit Multiple Retort Stokers
The Catholic University of America, Washington, D. C.

● Based on degree days, last heating season, Mr. R. E. Robson, Mechanical Superintendent of The Catholic University of America, Washington, D. C., estimates savings of approximately $2500 by use of Detroit Multiple Retort Stokers with new boilers. ● Mr. Robson has also expressed himself as highly pleased with the overall efficiency and the general operation of the Detroit Stokers. ● Design of Detroit Stokers embodies every feature which can promote economy both in fuel used and in maintenance. ● Deep, square, high capacity retorts, *inclined tuyeres . . . square rams* . . . adjustable moving retort bottoms that provide even fuel distribution . . . correct air distribution by zones . . . rugged, heavy construction—easy adjustment—these features make Detroit Multiple Retort Stokers exceptional in economy and satisfaction. ● Write for Bulletin 173.

## DETROIT STOKER COMPANY

Fifth Floor, General Motors Building ● Detroit, Michigan
Works at Monroe, Michigan . . . District Offices in Principal Cities
Built in Canada at London, Ontario

# We Improved on "Perfection"!

Not content with enthusiastic reports from users of thousands of Yarway Traps that "it's the best trap we have ever used"—Yarway have carried on their regular program of continuous research, development and refinement to make this trap even better than ever before.

***Cadmium-Plated Body, inside and out.*** We couldn't improve upon the rugged cold-rolled steel bar-stock body for strength and durability—so we improved its finish. Hence the new Yarway Impulse Trap bodies are bright cadmium-plated inside and out, for durable rust-free protection.

***Valve and Seat Stainless Steel, heat-treated.*** We couldn't improve upon the simplicity of "one moving part" design—so we added a bonus of years to its life. Hence the new Yarway Trap valve and seat are stainless steel, heat-treated, to practically eliminate wear.

These refinements have been added to the following revolutionary features that this trap has always offered:

- ***Low price***—often cheaper than repairing other traps.
- ***Light weight***—needs no support.
- ***Small size***—low radiation loss.
- ***Insures quick heating***—will not air-bind.
- ***Operates on exclusive Impulse principle.***
- ***Requires no priming***—it is self-priming.
- ***Easily installed.***
- ***Six sizes***—½ in. to 2 in. for pressures to 400 lbs.
- ***Proven by years of severe service.***

Check these features and you'll recognize a new avenue to Steam Trap Economy for your plant.

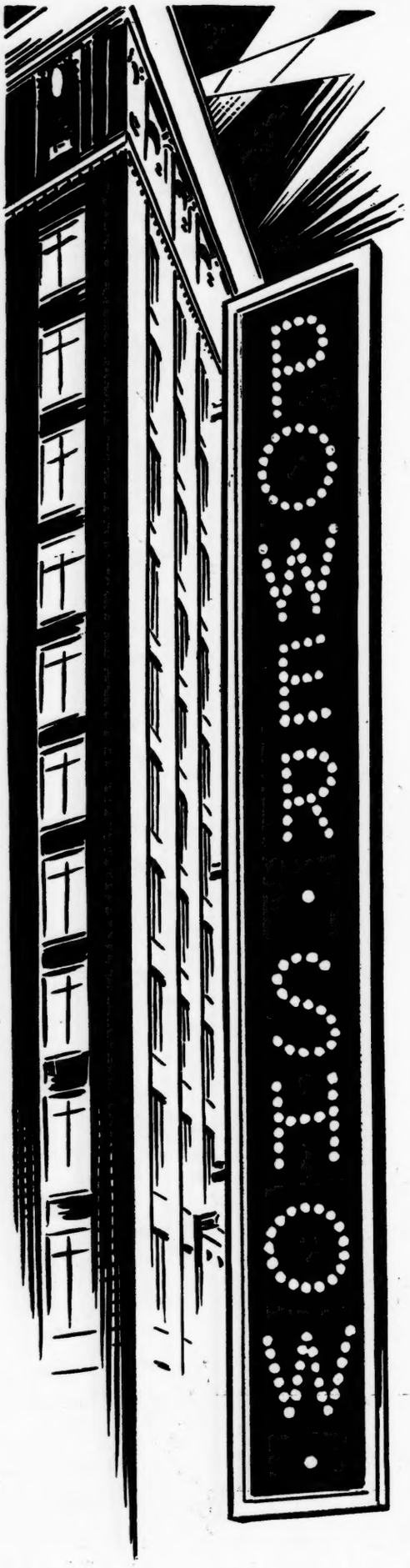
Ask your mill supply house or write for Catalog T-1721.

YARNALL-WARING COMPANY
104 Mermaid Avenue Philadelphia

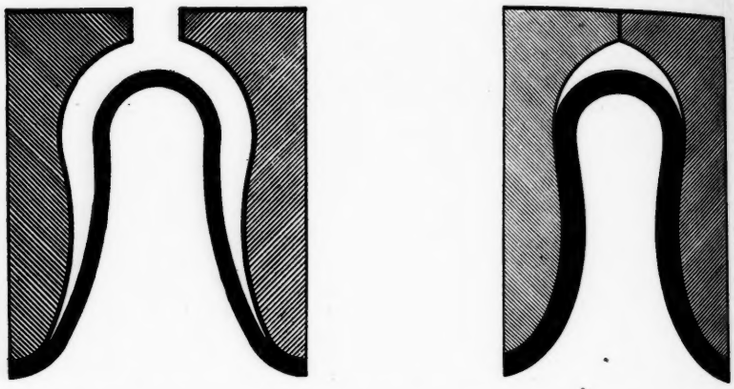
YARWAY

ANOTHER YEAR OF WIDESPREAD POPULARITY

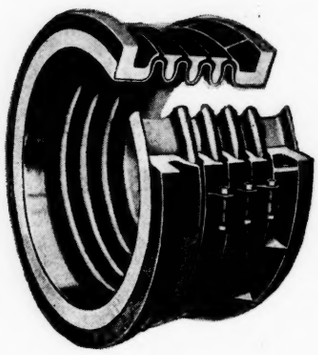
# IMPULSE STEAM TRAP



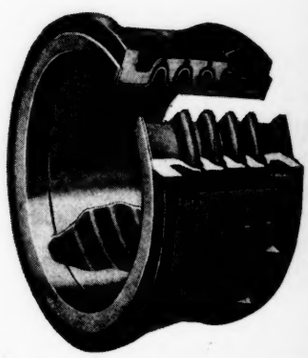
# SEEING



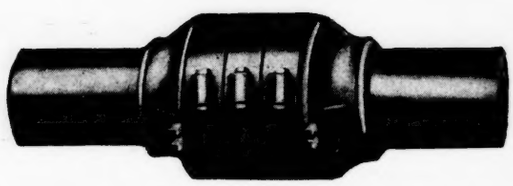
Two drawings, which illustrate an important part of the DIRECTED FLEXING principle. It is the all-curve corrugation (solid line) which during flexing wraps and unwraps itself, using the all-curve equalizing rings (hatched sections) as guides as well as limiting members. The flexing movement is progressively controlled throughout.



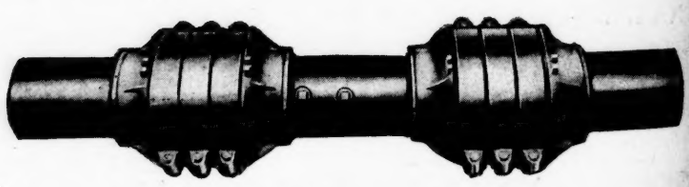
Standard Flanged Type Copper and Stainless Steel Joints.



Showing the Monel Telescoping Sleeve used in both flanged and welding end joints for protection against superheated steam.



Single Welding End Joints (copper only).



Double Welding End Joints (copper only).

# HEAT LOADS OF GAS APPLIANCES

## TABLE 1

### Gas-Fired Appliances

#### Restaurant Appliances

| | B.t.u. per Hr. | | B.t.u. per Hr. |
|---|---|---|---|
| **Boiling and Heating Liquids** | | **Cooking and Baking** | |
| Coffee-maker | | Broiler | |
| regular burner | 9,000 | counter type | [illegible] |
| simmer burner | 1,800 | Fryer | |
| | | counter type | [illegible] |
| Coffee urn | | Griddle (per burner) | [illegible] |
| 2 gal. | 4,400 | Hot plate | |
| 3 gal. | 6,500 | simmer (per burner) | [illegible] |
| 5 gal. | 8,000 | regular (per burner) | [illegible] |
| 7 gal. | 9,800 | Ovens (per cu. ft. of oven volume) | [illegible] |
| 15 gal. | 16,000 | Ranges | |
| 20 gal. | 22,000 | regular burner | [illegible] |
| | | giant burner | [illegible] |
| Egg boiler (per burner) | 1,500 | simmer burner | [illegible] |
| | | ovens (per cu. ft. of oven volume) | [illegible] |
| Oyster stewer (per burner) | 2,000 | oven pilot | [illegible] |
| | | broiler (per sq. in. of broiler area) | [illegible] |
| Water heater | | Steam table | |
| 2 gal. | 8,800 | counter type (per burner) | [illegible] |
| 3 gal. | 13,000 | Toaster | |
| 10 gal. | 16,000 | 180 slices per hr. | [illegible] |
| 15 gal. | 20,000 | 360 slices per hr. | [illegible] |
| | | 720 slices per hr. | [illegible] |
| | | Waffle iron (medium) | [illegible] |

#### Domestic Appliances

| | B.t.u. per Hr. | | B.t.u. per Hr. |
|---|---|---|---|
| Coffee-maker stove | 9,000 | Ranges | |
| | | small burner | [illegible] |
| Hot plate | | regular burner | [illegible] |
| small | 1,800 | giant burner | [illegible] |
| medium | 9,000 | ovens (per cu. ft. of oven volume) | [illegible] |
| | | oven pilot | [illegible] |
| Waffle iron (medium) | 8,000 | broiler (per sq. in. of broiler area) | [illegible] |
| | | pilot on top | [illegible] |

#### Miscellaneous Appliances

| | B.t.u. per Hr. | | B.t.u. per Hr. |
|---|---|---|---|
| Hair dryers (per helmet) | 5,000 | Refrigerators | |
| Irons | | 2—4 cu. ft. | [illegible] |
| | | 5 | [illegible] |
| medium | 2,300 | 6—10 | [illegible] |
| large | 3,400 | 12—18 | [illegible] |

Figures are thermal equivalents of nameplate rating of a typical appliance.

## TABLE 2

1.—Unvented burners or appliances—use the figures of the table as the maximum possible heat which may reach the room air.

2.—Fully vented burners or appliances—neglect the heating of combustion if the effect of air passing to the flue has been allowed for in computing ventilation air or filtration air.

3.—Hooded burners or appliances—consider from 60 to 90% of the heat shown in the table as possibly reaching the room air.

4.—Hooded and shielded burners or appliances—consider 50 to 60% of the heat shown in the table as possibly reaching the room air.

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H & V's REFERENCE DATA—91

# HEAT LOADS OF GAS APPLIANCES

An important problem in estimating the cooling capacities required for summer air conditioning installations is the determination of the amount of heat added to the conditioned space by gas-burning appliances. Since the cooling equipment is sized to take care of the peak load it is necessary to determine the heating load of the gas appliances during the peak period only. There are several methods which can be used to solve this problem, all methods requiring a knowledge of the nameplate reading of the appliance in B.t.u. per hour or the equivalent of this information.

To assist in preparing estimates the tables on the other side of this sheet have been prepared. Table 1 lists the nameplate ratings of a large number of typical gas-fired appliances, while Table 2 gives some of the factors for applying these data.

In Table 1 the restaurant appliances are separated from the domestic devices because in general those designed for restaurant use have a larger capacity and may give off more heat.

Before attempting to use Table 1 the estimator should be sure that he understands the nature of this information. The first point to be noted is that while the ratings given the various appliances represent typical appliances they do not hold for all appliances since these devices have not been fully standardized. If accurate information is necessary concerning some particular appliance it must be found individually instead of using the figures from the table. However, gas-using appliances are nearly enough standardized to make the table useful in practically all cases excepting a very few where extreme accuracy is desired.

The second point to be noted is that the table shows B.t.u. per hour contained in the gas fed to the appliances and not the B.t.u. per hour added to the room air. The quantities also assume steady operation of the appliances with gas being fed at a constant rate for a full hour. Since gas appliances operate intermittently or with throttle gas feed oftener than they operate steadily, it is necessary to make allowances for this.

The way in which the appliance is installed must also be considered. In some cases the flue gases are released directly into the room air and these gases diffuse with the air, warming it somewhat. In other cases, the flue gases are segregated completely from the room air and discharged separately to the outside. There are no generally accepted data available on the effects of venting and shielding of gas appliances but it is believed that the rules of practice which are given in Table 2 are justified.

## Making an Estimate from the Tables

The figures in Table 1 when modified by the factors in Table 2 permit finding the maximum amount of heat which a given gas appliance may add to the room air if operated steadily. What is necessary to prepare an estimate for determining equipment size, however, is a knowledge not of what heat each appliance may add to the room air, but of the amount which all of these appliances operating together do add at the time of the peak load.

There are two general methods of finding the required information. One is to go directly into the building or room and observe which appliances are operating there at various hours. Knowing the hour of the day when the system operates at peak it would be possible to determine how much gas is being consumed and from this calculate how much of an allowance to make in the estimate for cooling equipment capacity. This is essentially the survey method.

The second method makes use of data collected by others and put into suitable form for use. The information necessary can be collected from gas meter readings taken at short intervals in various kinds of buildings. These readings are then tabulated for the various types of buildings to show the ratio of the actual fuel consumptions for any particular time to the maximum possible consumption if all appliances were in operation. For instance, if the meter reading in a particular type of building had been found to show that during the peak hour only 40% as much gas had been used as if all the appliances had been operating steadily, then the ratio of the maximum meter reading to connected load is 0.40, and we say the diversity of the load is 0.4. A table of diversity factors should give these figures for various types of buildings and for various hours of the day.

As soon as the equipment proposed or installed in a given building is known the total connected load can be found from the table. The connected load is obtained by merely adding together the gas consumptions of all the equipment and appliances. Then by multiplying the connected load by the diversity factor we can find the gas consumption during the peak hour. An additional allowance must be made if the burners or appliances are vented or shielded. This method may be called the "Factor Method." The main difficulty in utilizing this method is the fact that data on diversity factors for buildings operating under a variety of conditions and hours have not been collected and tabulated.

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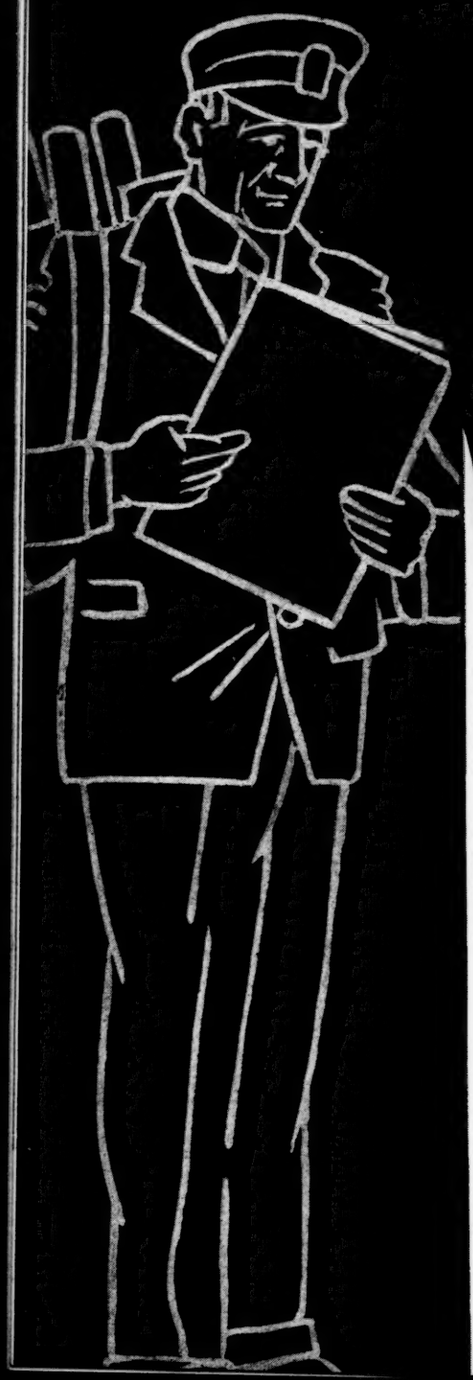

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**AIR CONDITIONING**

A YEAR OF PROGRESS

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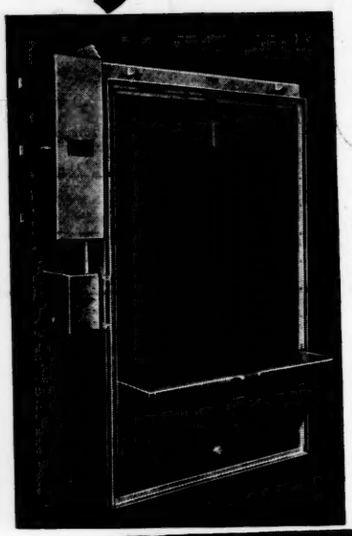
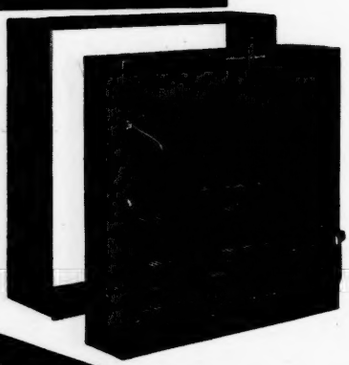
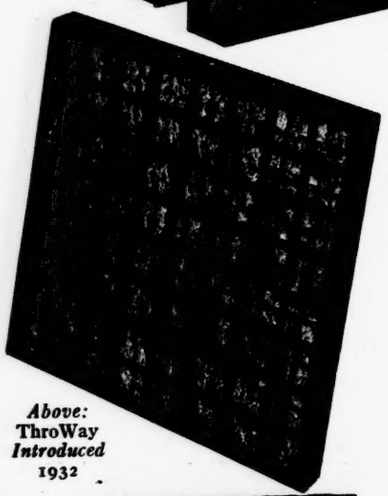


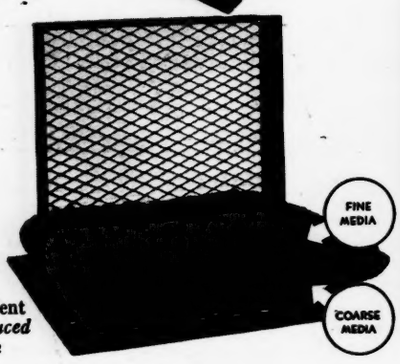
*Above:* Multi-Panel *Introduced* 1928



*Right:* American M/W 4 *Introduced* 1921



*Above:* ThroWay *Introduced* 1932




Renu-Vent *Introduced* 1932

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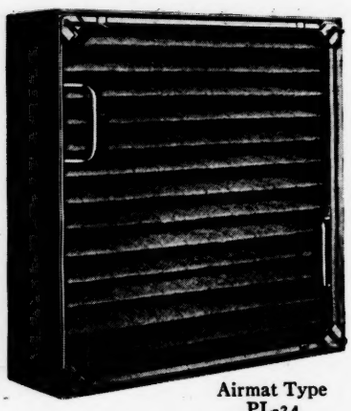

Airmat Type PL-24 *Introduced* 1936

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Youngstown butt weld pipe in the welding process. Youngstown Pipe is also produced by lap weld, electric weld and seamless processes.

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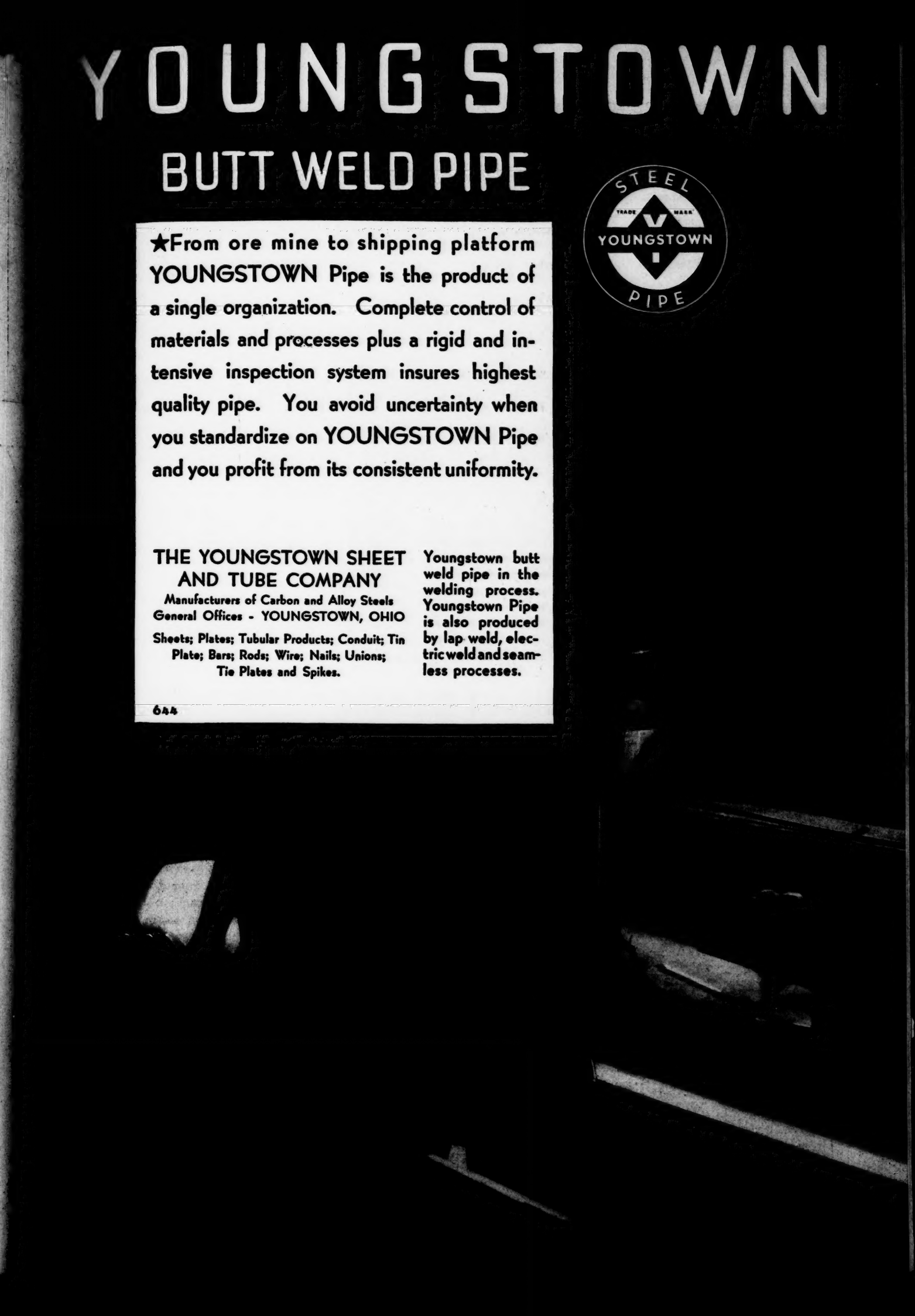
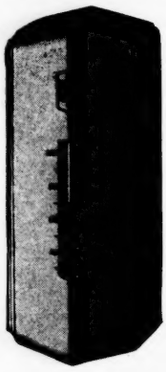


## TWO-ELEVEN ROOM THERMOSTAT



Artistically styled, sensitive and dependable, the Two-Eleven is available either with or without compensation (preheater)—both types in all models for heating, cooling, night and day, summer and winter and for three-wire circuits.

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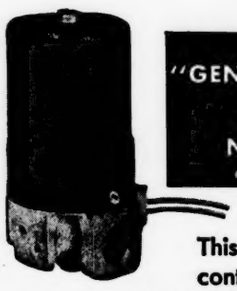

## "GENUINE DETROIT" SOLENOID NO. 683W2

This Solenoid for the control of humidification water supply, is THE silent solenoid—no disagreeable A. C. hum can be telegraphed through the water pipe to living quarters above. A heavy kick-off spring and ingenious needle and seat construction eliminate any tendency to stick. The No. 683W2 readily opens against any city water pressure. Another model "Genuine Detroit" Solenoid is available for refrigeration lines.

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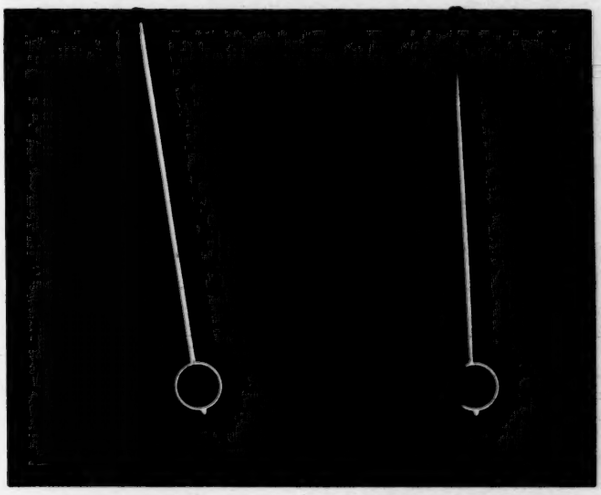

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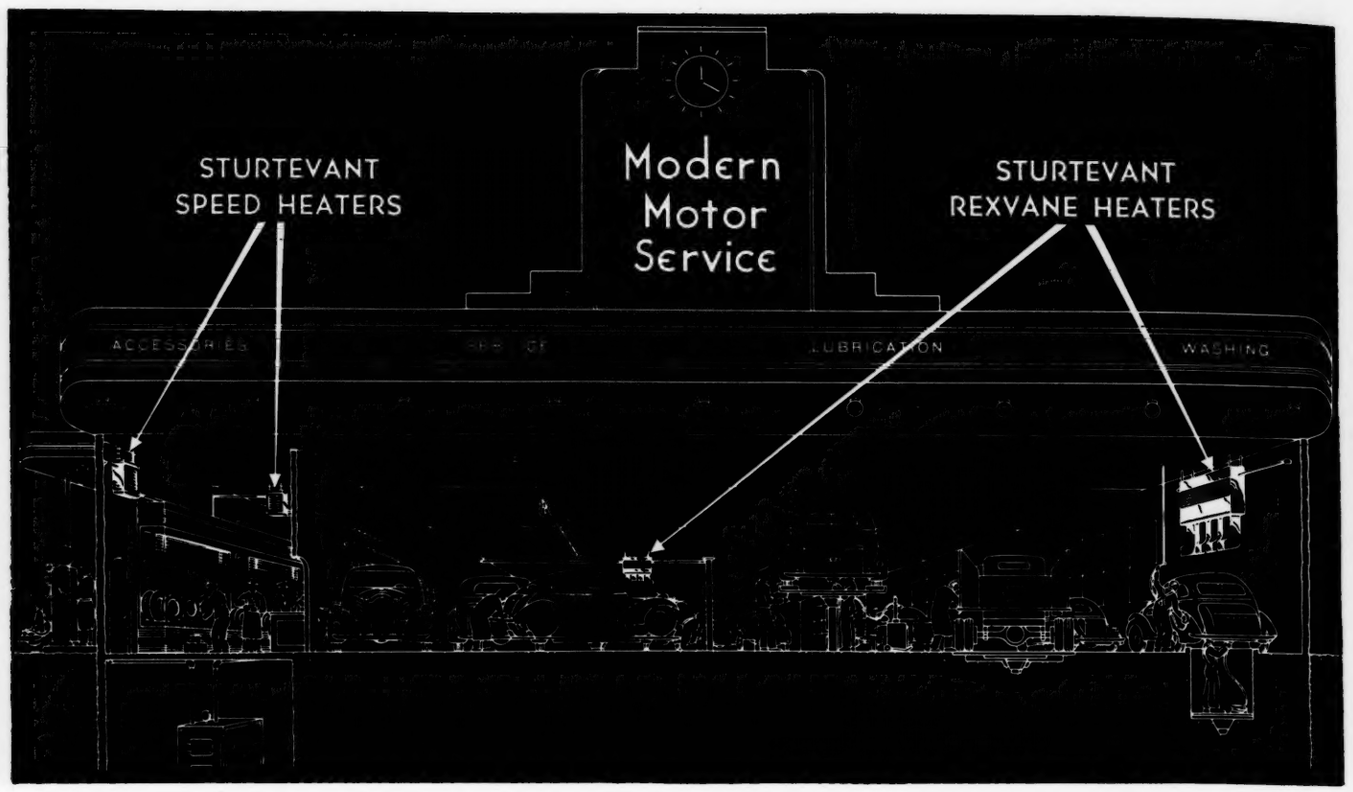
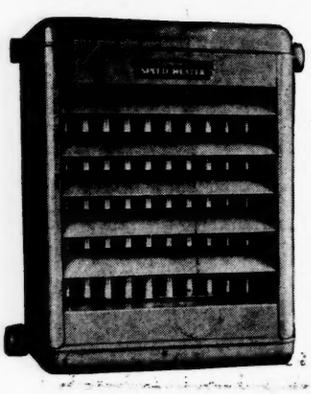
FOR ALL TYPES OF HEATING, VENTILATING, AND AIR CONDITIONING SYSTEMS

# *They Kill Cold*

## in Super Service Stations




## Tough heating problem licked by Sturtevant Units



Speed Heaters are available in 10 sizes up to 329,000 B.T.U. (standard rating). Distributed by Crane Co.

WIDE open doors... high ceilings... draft-swept floors. A tough heating problem... but Sturtevant Unit Heaters have licked it for super service stations throughout the country.

See the typical station above. Sturtevant Rexvanes handle the heating job in the large service areas. A Speed Heater or two take care of the sales room. For rooms where appearance is important the handsome Unit Ventilator is used.

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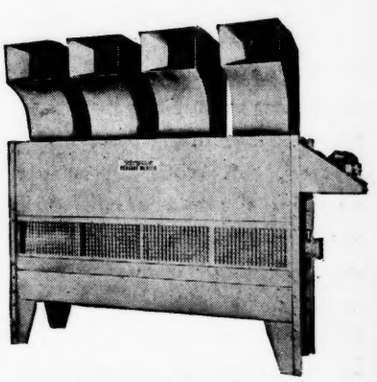

Rexvane Heaters for floor, wall or ceiling installation. A wide variety of types and sizes up to 1,421,000 B.T.U. (standard rating.)

**Sturtevant** *Unit Heaters*
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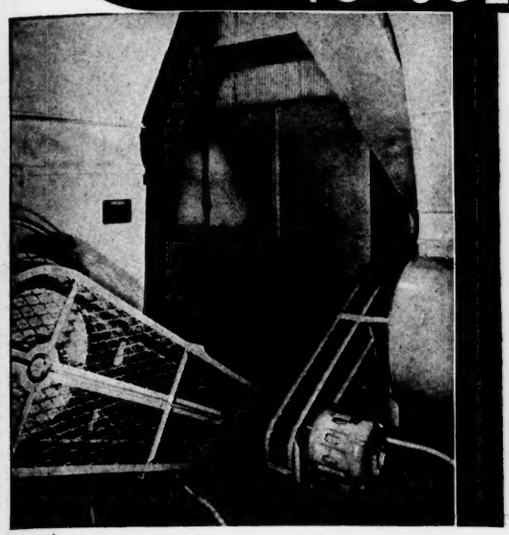
Choose Wagner Motors

# On Your Next Air-Conditioning Installation

## TO SOLVE YOUR DRIVE PROBLEMS

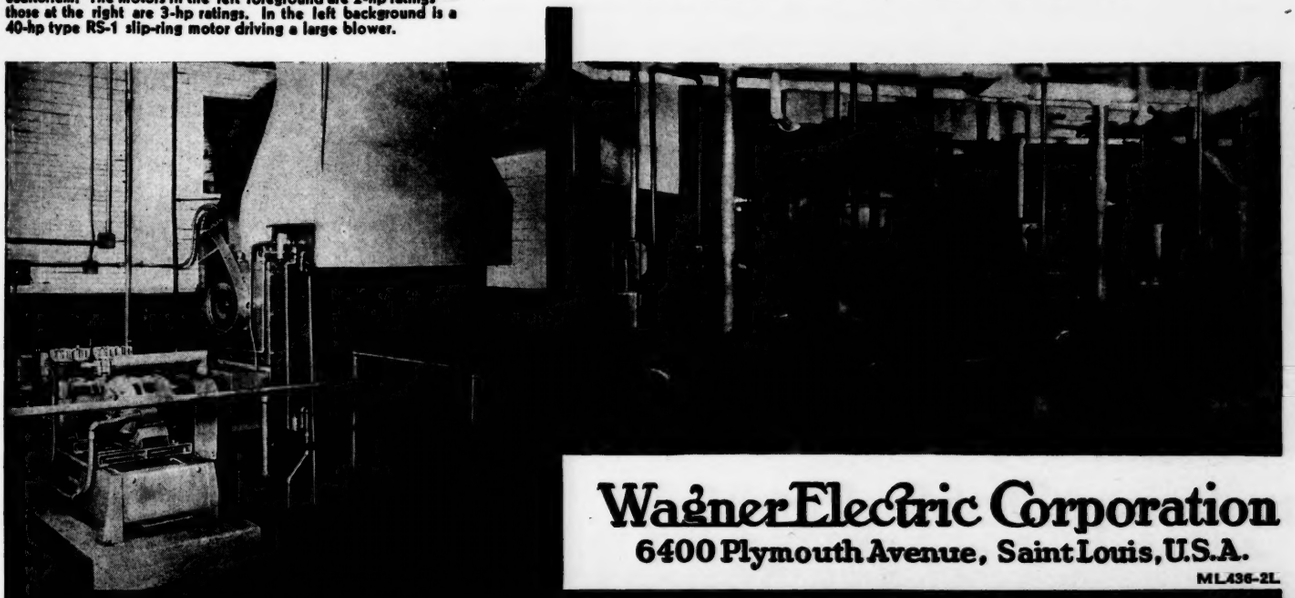


The three air-conditioning installations shown are typical applications of Wagner motors on: (1) ventilating equipment, (2) compressors, and (3) pumps. The illustration above shows a Wagner 2-hp type RP-1 squirrel-cage motor driving an exhaust blower installed in a large building. A 5-hp Wagner motor (not shown) is located behind the blower at left. The picture below shows a duct-type air-conditioning installation located in the basement of an office building. The compressor is driven by a Wagner 10-hp type RP-4 squirrel-cage motor. Conditioner (motor not shown) is driven by a Wagner 3-hp motor. The photo at the right illustrates Wagner type RP-1 squirrel-cage motors driving pumps used in connection with the air-conditioning system of a large auditorium. The motors in the left foreground are 2-hp ratings — those at the right are 3-hp ratings. In the left background is a 40-hp type RS-1 slip-ring motor driving a large blower.

DEPENDABLE, economical and efficient operation of any air-conditioning installation depends largely upon the reliability and performance of the electric motors that drive the equipment. Because air-conditioner manufacturers have recognized the importance of dependable and capable air-conditioner motors, an increasing number of manufacturers have chosen Wagner motors to solve their drive-problems for air-conditioning installations. They know that the selection of Wagner motors helps make their equipment give better, more dependable, more economical, and more efficient service.

Wagner builds all types of motors generally applied on air-conditioning machinery. Consequently air-conditioner manufacturers can choose motors exactly suited for their installations. Wagner motors are available with proper mechanical and electrical characteristics to fit the varying requirements of compressors, pumps, air-movement devices, and all types of ventilating equipment.

Consult Wagner on your next air-conditioning design or installation problem. Wagner's many years of experience in designing and building motors for air-conditioning equipment will prove helpful. Descriptive literature will be sent upon request.



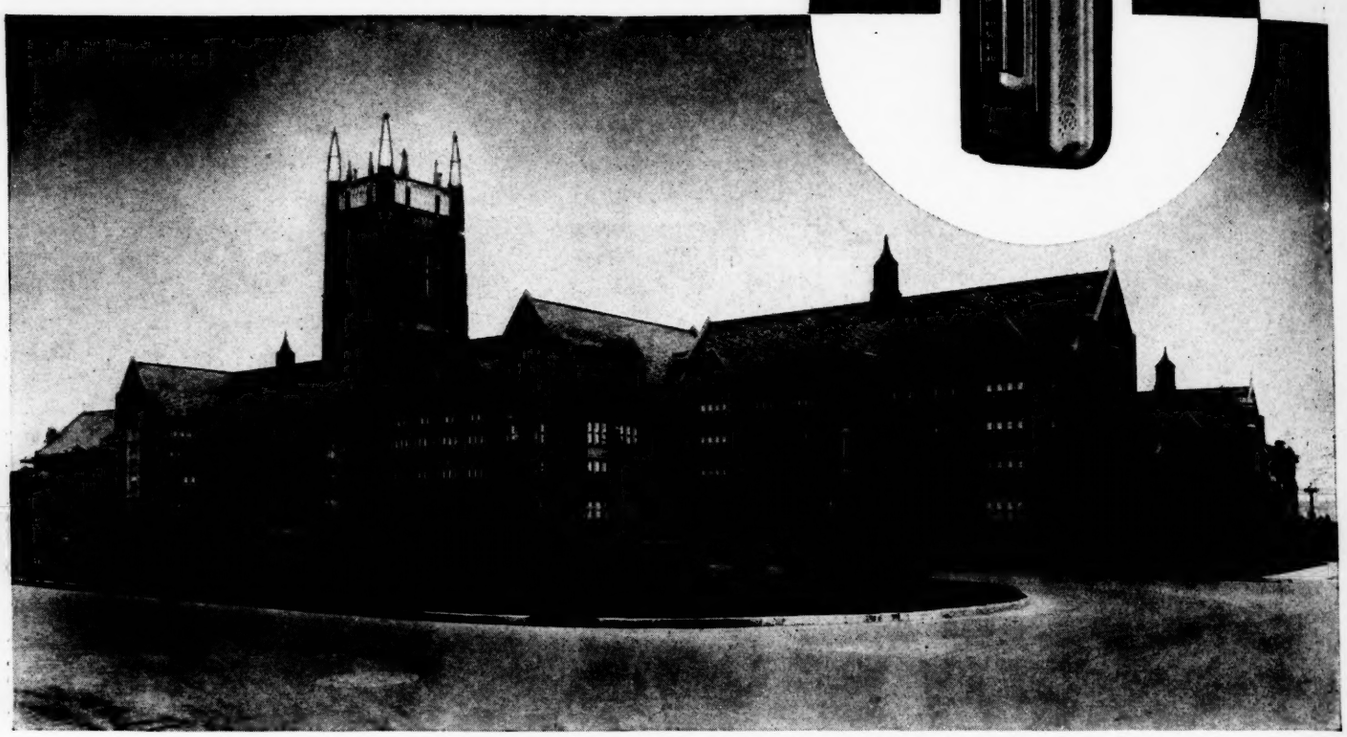
**Wagner Electric Corporation**
6400 Plymouth Avenue, Saint Louis, U.S.A.

ML436-2L

THERE IS A WAGNER MOTOR EXACTLY SUITED TO MEET YOUR REQUIREMENTS.

# *The Watch Dog of Efficient Economy*

# JOHNSON CONTROL



Sacred Heart Seminary, Detroit, Michigan. Architects: Donaldson & Meier. Mechanical Engineers: McColl, Snyder & McLean. Heating and Ventilating Contractors: Harrigan & Reid.

Fuel costs so much today that it is more than ever essential to prevent wasted dollars from rolling out of the windows! JOHNSON Control Apparatus acts as a positive, efficient check on waste. Carefully planned automatic temperature control is an assurance of correct temperature conditions indoors during the entire heating season.

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JOHNSON, oldest heat control apparatus company—dean of the industry—always has emphasized quality. Superior workmanship and engineering assure JOHNSON users the very best solution of any temperature or humidity control problem. Design, manufacture, and installation by a single organization with a background of more than fifty years. Johnson Service Company, Milwaukee, Wisconsin, and all principal cities.

# JOHNSON

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***For Heating - Cooling - Ventilating & Air Conditioning Systems***

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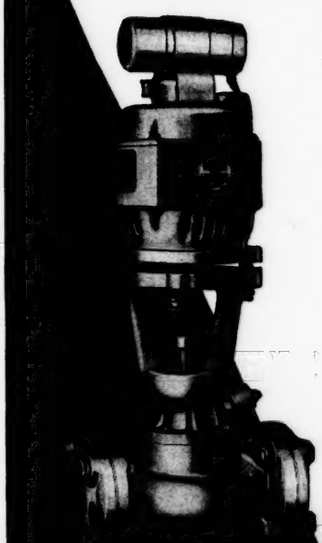

OVERHEATING is wasteful of fuel, harmful to health and extremely unpleasant. With only one Flow Control Valve Thrush engineers have completely eliminated the possibility of overheating because the Thrush Flow Control Valve closes tightly. Air and gases are vented and expansion provided for beneath the valve seat. This is an exclusive Thrush feature and prevents all leakage when heat is not needed in the radiators . . . especially important when the system is used for year 'round domestic hot water supply. Thrush Flow Control System is the simplest complete system of hot water heating control ever devised. It costs less and is easier to install and there is nothing to get out of order. Use the coupon now.

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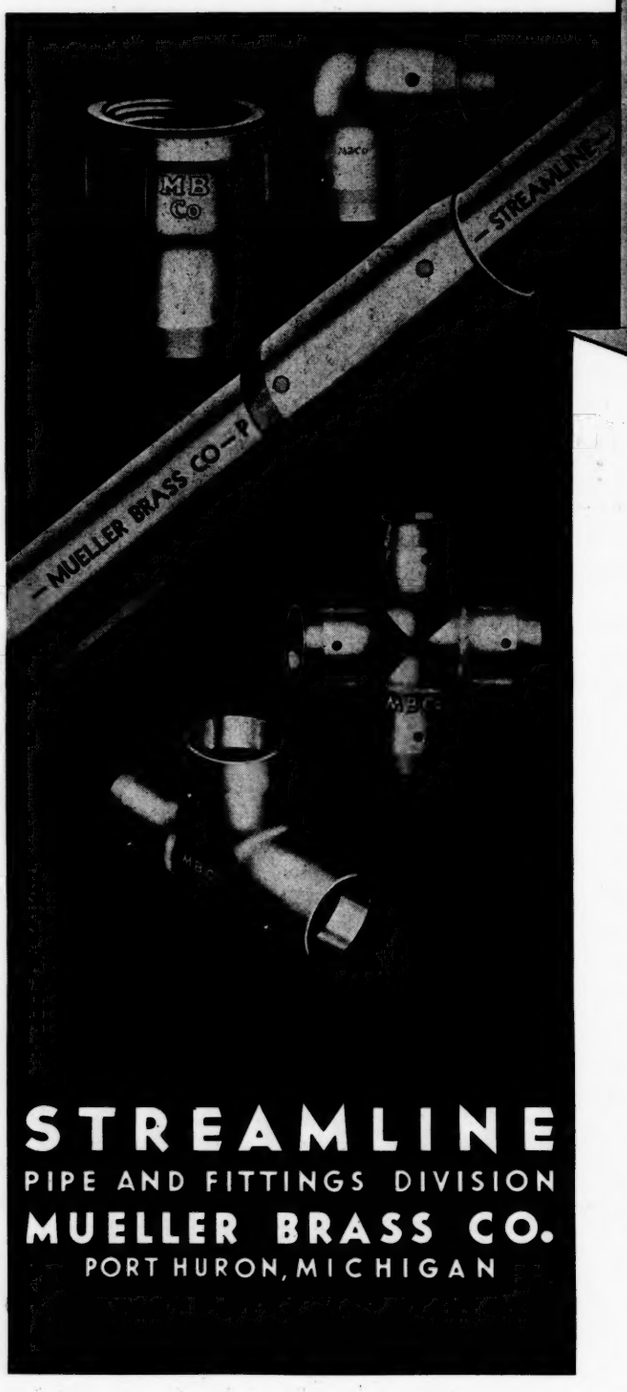
## *for* MODERN HEATING *and* AIR CONDITIONING




**STREAMLINE**
PIPE AND FITTINGS DIVISION
**MUELLER BRASS CO.**
PORT HURON, MICHIGAN

● THERE is no material as modern and practical as STREAMLINE Copper Pipe and Solder Fittings for piping jobs—nor can you use anything more satisfactory to yourself and customers, whether it be for plumbing and heating conducting systems or for the manufacture of air conditioning equipment.

STREAMLINE Copper Pipe and Fittings are the ideal material for concealed convection type heaters, unit heater coils, gas fired type boilers, indirect water heaters, booster heater coils, humidifiers, dehumidifiers, condensers, and the multitude of other uses.

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# SAVES YOU ITS FULL COST ON FIRST JOB

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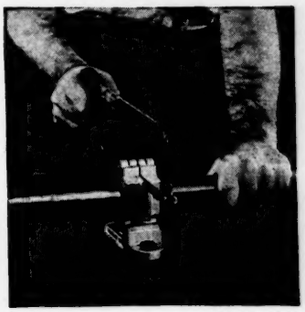

This TRIMO product sizes and holds tubing to round while it is being cut. Makes every cut one hundred percent square. And by eliminating damaged tubing which might have to be thrown away, more than pays for itself on its first job.

Invest in a TRIMO Sawing Vise Set. It will be a money-making investment for you.

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USED *Exclusively* IN THE

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If your product calls for reliable, automatic action at a given temperature, use Chace Thermostatic Bimetal. Sold in sheets, in strips or formed for assembly.

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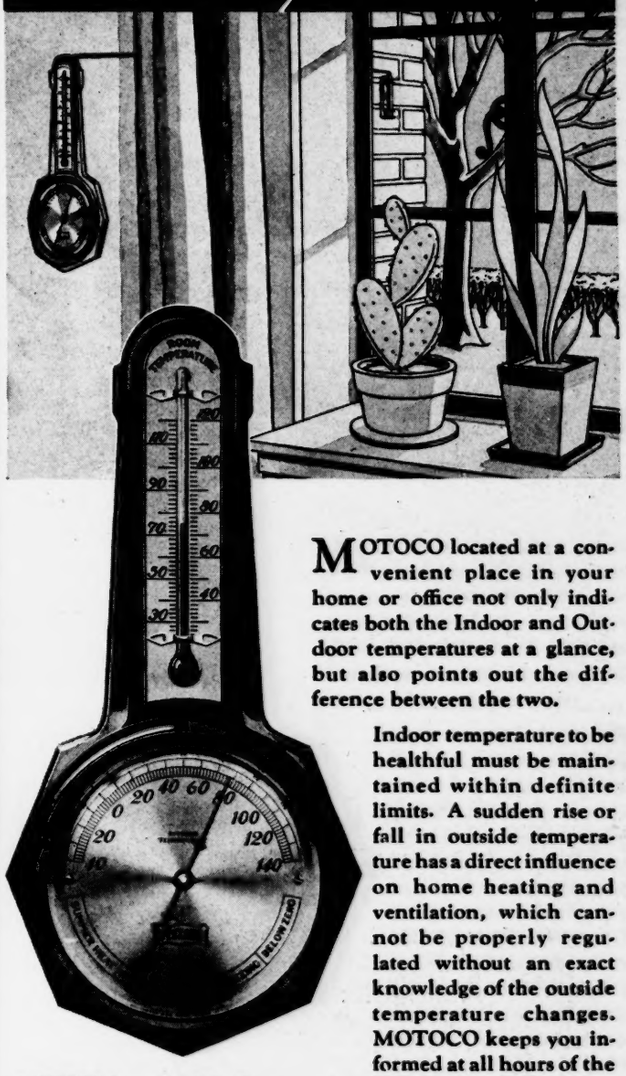
# INDOOR and OUTDOOR TEMPERATURE *at a Glance!*




MOTOCO located at a convenient place in your home or office not only indicates both the Indoor and Outdoor temperatures at a glance, but also points out the difference between the two.

Indoor temperature to be healthful must be maintained within definite limits. A sudden rise or fall in outside temperature has a direct influence on home heating and ventilation, which cannot be properly regulated without an exact knowledge of the outside temperature changes. MOTOCO keeps you informed at all hours of the day or night.

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The Motoco line also includes Distance Reading Thermometers, Recording Thermometers, Pressure & Vacuum Gauges and Pressure & Vacuum Recorders for Industrial application.

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*A post card request will bring you complete details of Motoco precision instruments.*

MOTOCO
INDOOR AND OUTDOOR
THERMOMETER
PRICE
$12.00

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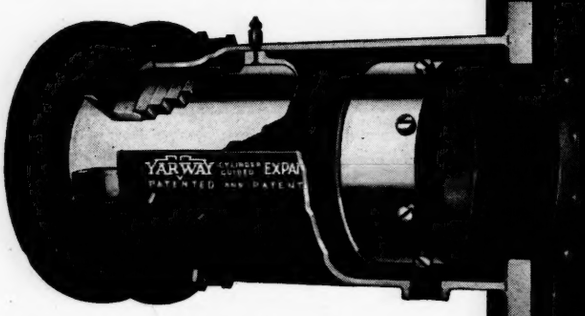


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Representatives desired will preferably be experienced in distribution of heating specialties. Will only consider well established, successful organization or individuals.

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**Care HEATING AND VENTILATING**
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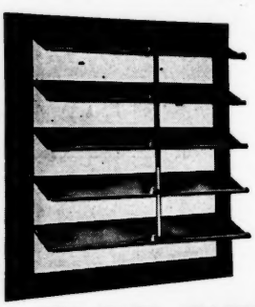

Bearing-equipped, weather stripped, well-designed **ELGO AUTOMATIC SHUTTERS** operate most efficiently by gravity — provide assured protection to the fan against corrosion. For use with propeller or disc fans, impellers or blowers, **ELGO AUTOMATIC SHUTTERS** give a lifetime of satisfactory, trouble-free service — at a surprisingly low cost. Details and prices upon request. No obligation.

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ALL WATTS PRODUCTS ARE..

# Accessible

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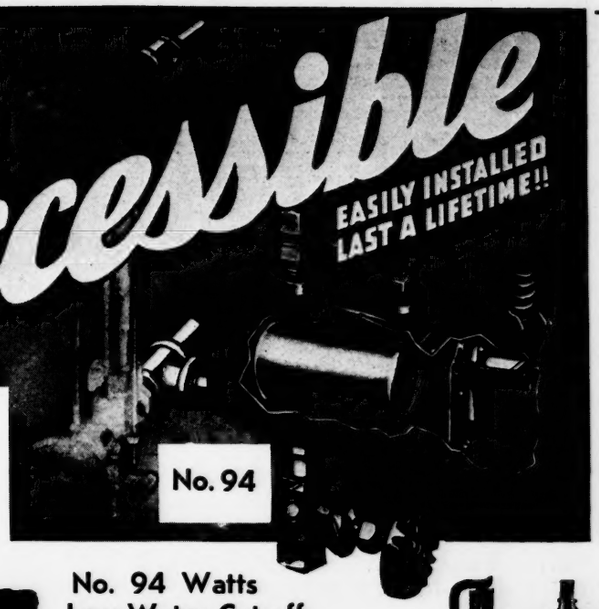


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Built for service and permanency, Watts line is designed for easy access and quick, inexpensive installation. Specify Watts products.

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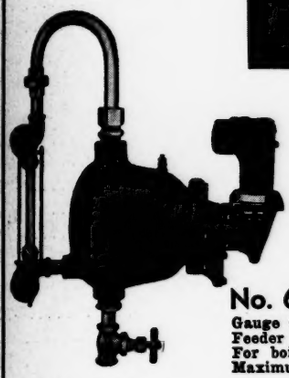

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Incorporates the principle of direct float action on a precision-built switch with simplified gauge glass installation. Offers low cost features.

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WATTS REGULATOR COMPANY
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**Accurate Within 1% — Factory Tested**

Measures steam consumption from heating plants, process equipment in industrial plants or institutions. Easily installed. Easily cleaned. Seven sizes from 250 to 12,000 lbs. per hour for vacuum or gravity service. Hundreds in daily use.

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OVER FIFTY YEARS IN BUSINESS



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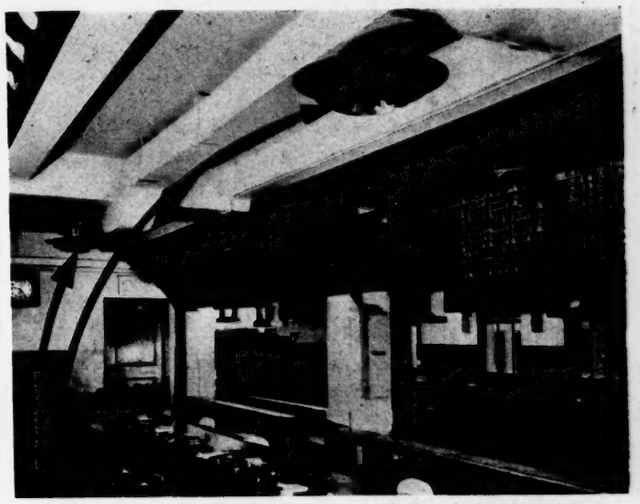

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| Distributed through individual Anemostat | 800 c.f.m. |
| Velocity in Anemostat neck | 1400 f.m. |
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| Number of people in Room | 80 |

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**ANEMOSTAT CORP. of America, 551 Fifth Avenue, New York**

**No Air Conditioning System is Better than its Air Distribution**

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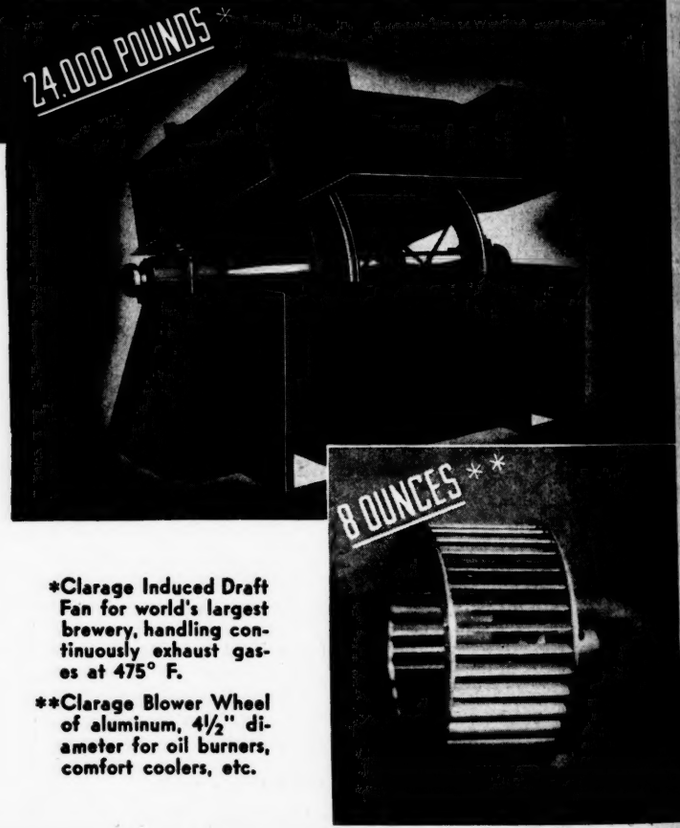


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**When you need air conditioning in your factory, office, store, hotel or theatre, fans for any service, or mechanical draft in your power plant, consult Clarage first.**

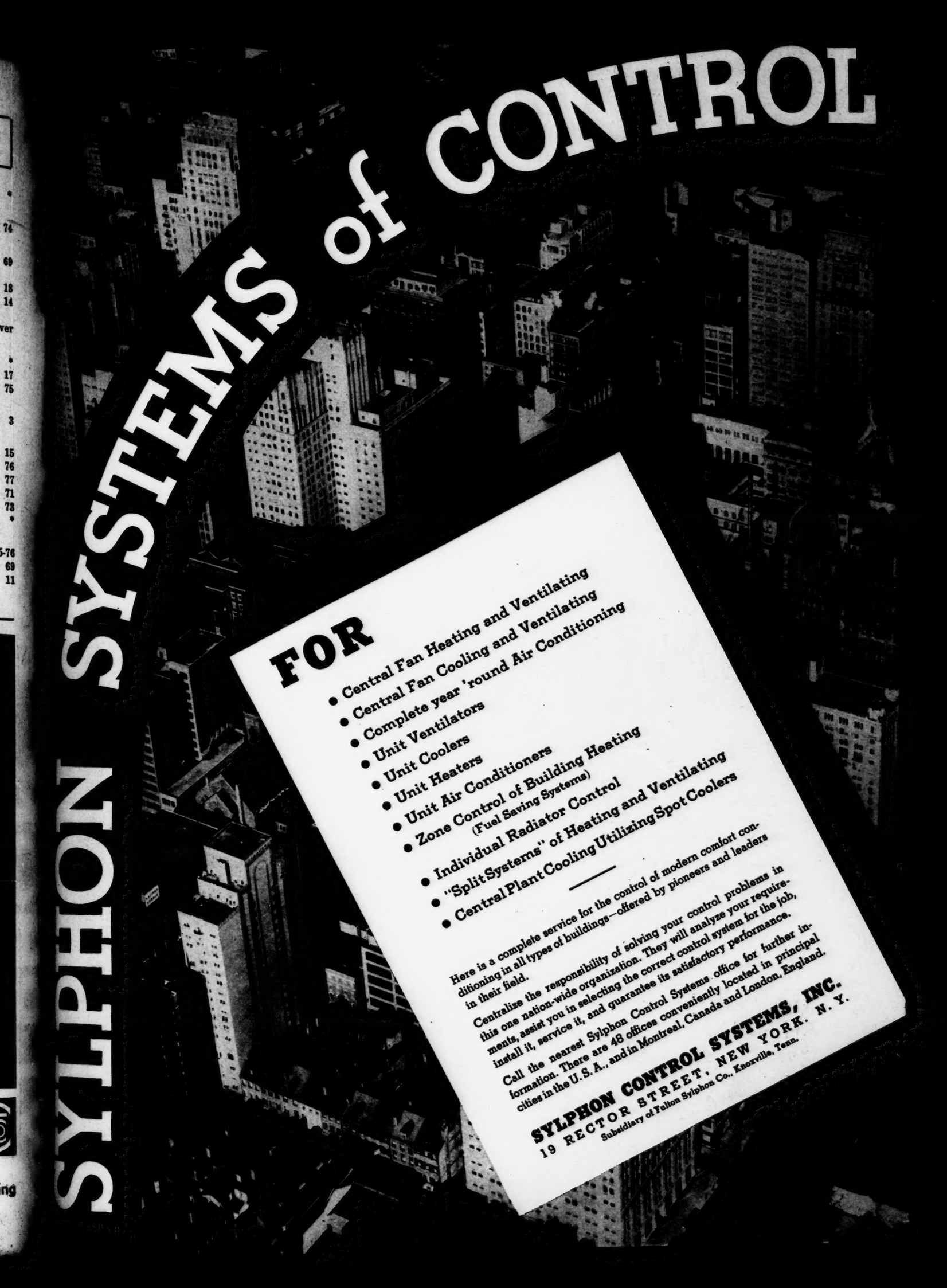
**Big job or small—8 ounces to 24,000 pounds of expert engineering and A-1 construction—we have the facilities to meet any requirement exactly.**

*Clarage Induced Draft Fan for world's largest brewery, handling continuously exhaust gases at 475° F.

**Clarage Blower Wheel of aluminum, 4½" diameter for oil burners, comfort coolers, etc.

SPECIFY CLARAGE for COMPLETE AIR CONDITIONING · VENTILATION · HEATING · COOLING · MECHANICAL DRAFT · FANS & BLOWERS FOR INDUSTRIAL NEEDS

**CLARAGE FAN COMPANY - KALAMAZOO, MICHIGAN**
SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES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• Unit Heaters
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Centralize the responsibility of solving your control problems in this one nation-wide organization. They will analyze your requirements, assist you in selecting the correct control system for the job, install it, service it, and guarantee its satisfactory performance.
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19 RECTOR STREET, NEW YORK, N. Y.
Subsidiary of Fulton Sylphon Co., Knoxville, Tenn.

# MODERNIZE FOR WINTER
## With The Heating Plant That Is
## ★ *Different* ★

WITH F. H. A. pressure being applied throughout the nation on modernizing-for-winter—a campaign in which Crane Co. is heartily cooperating—you have a real opportunity to reap the benefits of handling the Crane heating line.

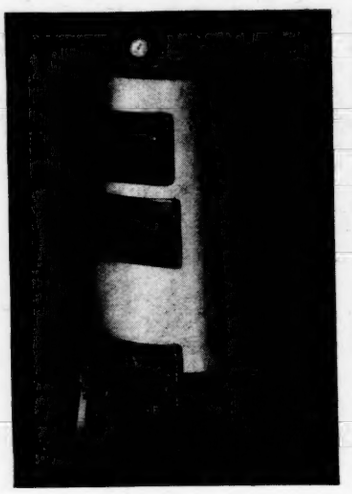
You'll begin to notice the difference the minute you unpack a Crane boiler. Every piece is crated so that it comes to your hand when you need it. No hunting around or pawing over a pile of materials looking for the right part.

You'll notice, too, the ease and speed with which you can draw up the sections. You test before the jacket goes on—and when you're ready for it the jacket pulls up tight in a jiffy with only four screws!

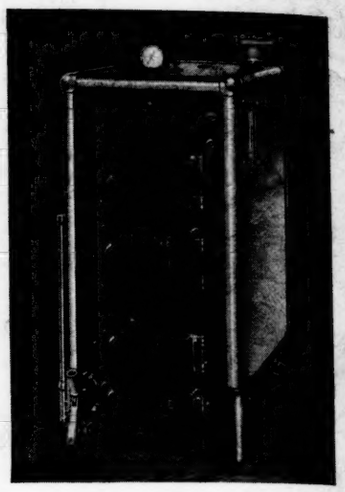
You can bank on a Crane boiler and your customer will in turn bank on you. For it means a sound, tight job that will operate with true fuel-saving economy.

Crane boilers have 50 per cent more horizontal "ceiling" heating surface over the hot gases than ordinary boilers. Patented baffles direct the water to the most efficient heating areas. This saves heating dollars in amounts big enough to count!

Crane Heating Systems include boilers for coal (hand or stoker-fired), oil or gas, for the operation of steam, hot water, vapor or vacuum systems, with or without air conditioning. You have your choice of Directed or Concealed Radiation plus the Crane Humidifying Radiator. Consult the nearest Crane Branch.



CRANE ROUND BOILER FOR COAL BURNING—The boiler with 24 radical improvements which result in substantial economies and great ease of tending. Readily adapted to oil burning.



CRANE COAL BURNING SECTIONAL BOILER—Has 50% more "ceiling surface" over the hot gases. Amazingly efficient. Quickly erected.

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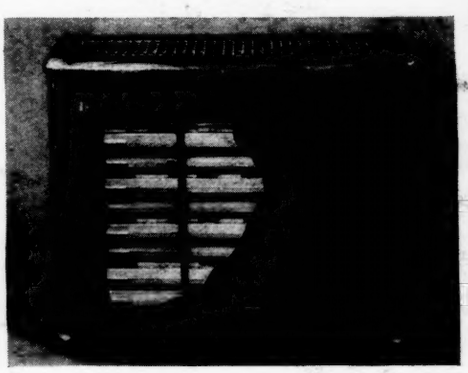
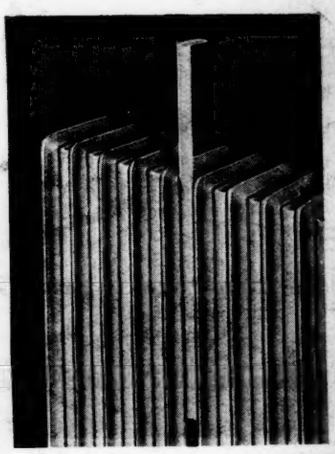
HUMIDIFYING RADIATOR—Large evaporating capacity in small space. Handsome cabinet enclosure. Easily and quickly installed, replacing ordinary radiation. Practically no operating cost.



DIRECTED RADIATION—Invisible shields direct heat into room, minimizing ceiling-floor temperature difference, protecting walls, etc., from smudge.



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